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Engineering News-Record

December 18, 1930

Composition of Earth Dams

Three authoritative articles presenting facts and conclusions drawn from recent studies of core materials in dams built by the hydraulic, semi-hydraulic and rolled-fill methods

C. H. EIFFERT
Chief Engineer, Miami Conservancy District

CHARLES E. WADDELL
Consulting Engineer
Asheville, N. C.

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Research Engineer, Bureau of Reclamation

Failure of the Corpus Christi Dam

Engineering News-Record Staff Report Upon the Partial Failure of the Dam on November 23

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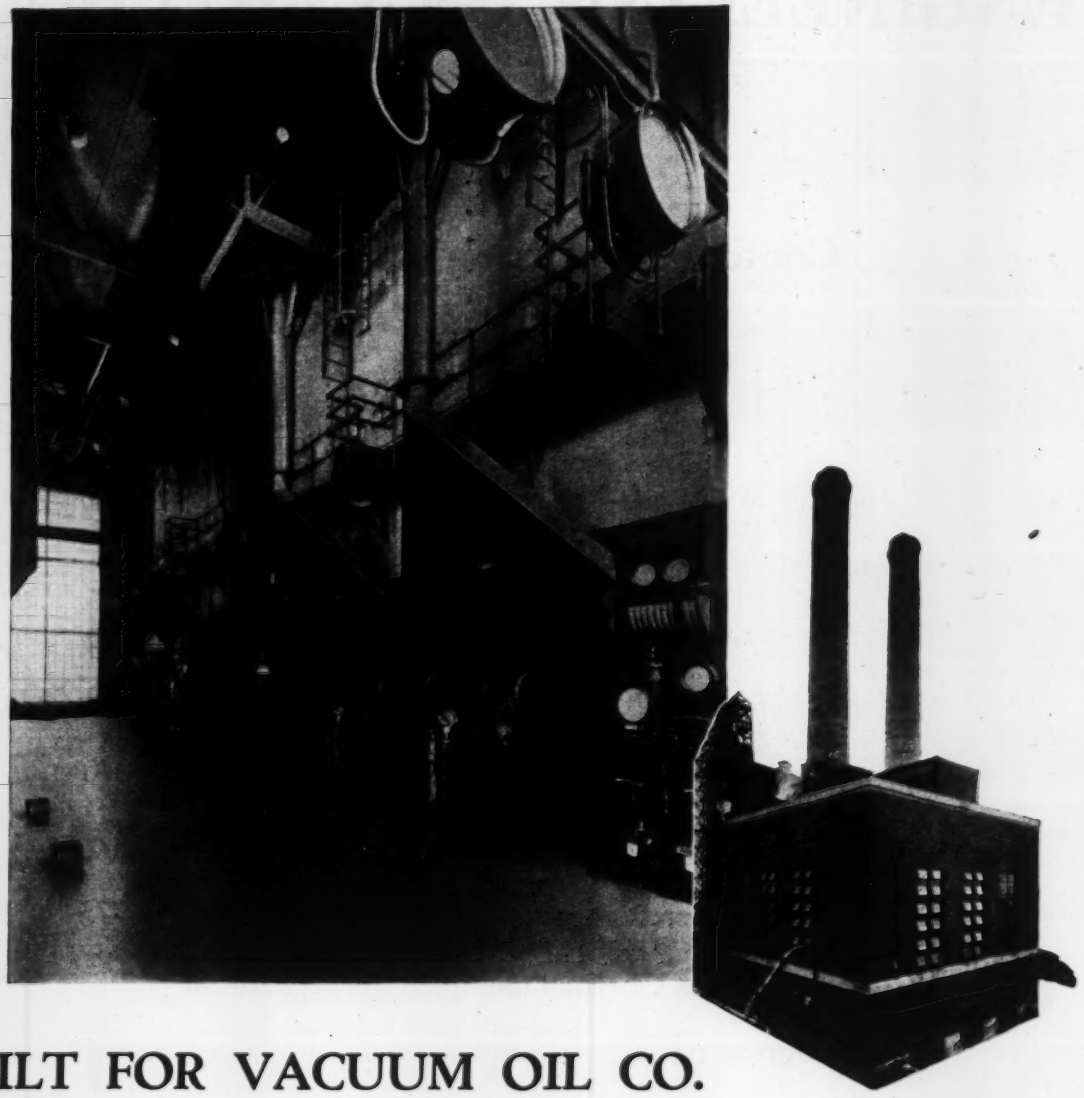

BUILT FOR VACUUM OIL CO.

This boiler plant erected for the Vacuum Oil Company at their Paulsboro, N. J., Oil Refining plant, supplies steam for process and electric power purposes. The building is 106′ x 108′ x 80′ high, of steel frame with exterior brick walls and concrete floors. The plant includes 3-1732 h. p. cross drum water tube boilers of maximum working steam pressure of 450 lbs., each equipped with superheaters, economizers, underfeed stokers and the necessary auxiliary equipment. The coal handling system has a capacity of 120 tons of coal per hour. Process steam is distributed to the various buildings through overhead steam lines on steel supports. One 3,000 kw. 80% p. f. horizontal non-condensing turbo generator was installed in the existing power house. Current is generated at 2300 volts, 3 phase, 60 cycle. This unit operates at 400 lbs. pressure, and exhausts at 190 lbs. gauge to the refining steam distribution lines.

Construction was started in February and the station was operating in November of the same year.

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

Volume 105 NEW YORK, DECEMBER 18, 1930 Number 25

Proper Refusal

IN REFUSING to be hurried into a report on revision of the Mississippi River flood-control project the Chief of Engineers, Gen. Lytle Brown, has acted with courage and wisdom. It was wise to recognize the necessity for delay and courageous to oppose congressional pressure for quick action. General Brown will not formulate conclusions on the present official plan and on the proper course until the facts are so fully determined and analyzed that the conclusions will be right and will merit indorsement by any competent reviewer. This course is wholly in agreement with what civil members of the profession have held for three years. It does a great deal—probably as much as can be done—to correct the bad results of the hasty promotion of the project in the latter months of 1927, the big flood year. The future of the flood project will thereby be made quieter and more successful, and such checkmating of progress as resulted from the struggles of the floodway residents against confiscation of their possessions is not likely to recur. Enough work lies ahead to occupy the coming year fully, even with the emergency appropriations about to be added as unemployment relief. Therefore the refusal to draw premature conclusions does not mean delay. On the contrary, it means that a satisfactory final result in protecting the Valley will be reached more quickly.

Soil Study

A TECHNICAL problem of first rank is under discussion in the present issue: hydraulic dam core stability. The three articles presented invite close study. Between the opposing demands of tightness, which means fine grain, and stability, which means varied size and interlocking, the soil sturcture of earth dams places difficulties before the engineer whose solution is hardly more than distantly approached. Ample proof of this may be found in the anxieties that beset the builder of dams and dikes, and in the many unforeseen mishaps that attend his work. Few things are a greater source of apprehension than leaks through such earth masses, and it is because we all have this apprehension instinctively that we remember so well the tale of the boy who plugged the leak in the dike with his arm. The hazard of slipping or semi-liquid outflow of the interior of hydraulic-process dams is no less a cause of apprehension, as the accumulating record of great slumps and mud flows bears witness. These facts underlie the discussion of dam cores. One reassuring feature of the case is that experience indicates less danger of accident after completion than during construction; stability increases steadily as the structure grows older. The Miami dams, which supply strong evidence in this direction, have not held water continuously, it is true, but no reason exists for believing that they would be less stable if they had served as impounding instead of mere retarding dams. In any event, the present three papers are a basis for discussion, to be published in a later issue, which we hope may include the contribution of every engineer familiar with the problem at first hand.

Some Dreams Come True

PEOPLE in Denver will tell you that dreams do come true. For years they have dreamed of their city being located on a through railway to the Pacific Coast. The Denver & Salt Lake Railway was projected with the idea in view, but it ended far short of its destination. Then the Moffat tunnel was built as a public undertaking to ease the difficult trip over the D. & S.L. to the Western Slope; but still no definite prospects of a through line, for the Denver & Salt Lake went nowhere and the projected Dotsero cutoff to connect it with the Denver & Rio Grande Western Railroad remained a paper project. Now, however, things have changed. The Denver & Rio Grande Western has been given permission to lease the Denver & Salt Lake Railroad on condition that it build the Dotsero cutoff, thus giving Denver a direct outlet to the West. The Rio Grande is owned jointly by the Missouri Pacific and the Western Pacific, and the Missouri Pacific in turn is controlled by the Van Sweringen brothers, whose railway lines extend eastward to reach the Atlantic seaboard through the Chesapeake & Ohio and the Erie railroads. Moreover, there are indications that the ambitions of the Van Sweringens will not be gratified until their railway lines reach the Pacific Slope. Thus Denver's dream bids fair to be realized. Soon the city may find itself not merely on a through line between the great railway centers of the Middle West and the Pacific Coast but on a line reaching from coast to coast.

Growing Highway Knowledge

KNOWLEDGE accumulates slowly, even in so active a field as highways. Some of the reasons for this may be read out of the many committee reports to the Highway Research Board within the past two or three years, reports which outline in detail for different parts of the highway field what researches are required to answer current questions of practice. Most of the ground surveyed in these reports remains uncovered, and from this point of view the activities of the board appear a bit disappointing. However, the very existence of such a forum for the presentation of new knowledge of highways steadily draws into its circle the chief new facts and movements, and builds up an increasing strength of interest in research. Thus last week's meeting brought distinct clarification of knowledge of road capacity, fixed-plant cost of transportation, construction and repair methods, a brilliant contribution to knowledge of that extensive source of damage, frost heaving, and a report of the success attained with an ingenious process of raising and rebedding settled pavement slabs.

Knowledge does accumulate, in spite of the great number of questions still unannounced. The opportunities for highway research were never so promising as today.

Frost Action Explored

STUDY of frost action has been advanced significantly by the able investigations carried on in the Michigan highway department, and the first full review of its conclusions which was given by Burton and Benkelman before the Highway Research Board last week is therefore a valuable document. The magnitude of the problem is evidenced by the Michigan report that many hundreds of road sections were broken up by frost in a single winter. In such heaving the total rise is much greater than can be explained by mere expansion of the water contained in the soil, and this anomaly constituted the chief bar to the development of adequate preventive measures. With the discovery of the particular soil conditions responsible for frost heave, and a clear demonstration of the water-accumulating action which results from variation of air temperature in winter and consequent rise and fall of the frost line in the ground, the problem approaches control. The present winter should show how far the measures resorted to in Michigan are effective.

Destructive Energy Problems

PROBLEMS involved in destroying the energy of falling water are not new to engineers who are engaged in dam design, for erosion at the toe of dams and the creation of vacuum under hollow dams are common difficulties. For engineers in sanitary work they are much less common. In St. Paul, where outfall sewers are far below street grade, falling water in dropshafts connecting lateral sewers with the outfall tunnels has, in the past, caused serious trouble. Pressures built up by the air-pump action of such water presented an especially difficult problem. To meet this condition the engineers of the city have developed a new type of drop in which sewage flows down a spiral stair of concrete built in a circular concrete shaft. The energy of the water is dissipated, no air pressure is built up in the tunnels, and the shafts are accessible for inspection and repair at times of low flow. A difficult problem has been met simply and effectively.

A Significant Dam Failure

PENDING the official report of the board of engineers which is now investigating the failure of the Corpus Christi dam positive opinion as to causes and responsibility may properly be held in abeyance. The statement of the accident which is published in this issue gives the facts disclosed by a study on the ground. The structure and its ruins when inspected were still virtually undisturbed since the emptying of the reservoir laid them bare; but, obviously, until the buried parts of the spillway apron and the overturned abutments are uncovered and the extensive program of borings now in progress has disclosed what it may, the evidence in sight is meager as a basis for conclusions. There was no eyewitness of the failure, and the testimony of the ruins remains to be uncovered in part. The situation in all respects, therefore, invites caution in judgment.

The failure is particularly significant for two reasons: first, because the dam was an exceptionally bold challenge of the hazards of placing a masonry dam on pervious sand and gravel, and second, because failure was due to penetration of the structure or its foundation by impounded water, not to erosion by overflow. There was not at the time, nor had there previously been, any attack on the apron slab by the backwash of the jump where the water left the smooth concrete for the easily erodible earth of the valley floor. The water broke through the barrier that had been constructed to retain it despite the defenses of sheetpiling and blanketing.

Viewing the failure after the fact, it is easy enough to say that risks were taken in the design of a high concrete weir on piles, in the use of a partial cutoff wall and in some other elements of the design as related to the nature of the ground that had to be built upon. Proof that contrary action would have been economically justified or would have prevented failure is distinctly more difficult. But fuller discussion is premature while the investigating commission is still engaged on its studies. The one conclusion now in order is that founding a dam on an alluvial valley bottom calls for care and precaution beyond that required in most other undertakings of the civil engineer.

Public Service Administration

UP TO the present the development of the service branches of governmental units has made little use of the analogy existing between public service rendered by utilities and that rendered by public agencies. Due to historical reasons, these two classes of service are usually thought of as quite distinct, and their close parallelism, not to say identity, is overlooked. They have identical purpose and operate by the same method, so that they should be subject to the same principles of management and control. We believe that careful study of this relation is capable of bringing about important improvement in public service.

Governmental public service bureaus follow accounting and financial practices essentially different from those followed by utilities. The latter, being subject to commission regulation, are required to conduct their accounting in closely defined, uniform manner, with a view to making facts on service and cost available directly for supervision of satisfactory service and control of rates. Publicly operated services are not under such supervision, and therefore arrange their accounts as they please. But it is clear that the facts of service and cost should be as definite in the one case as in the other. It is also clear, if we examine the question with care, that if control is definite in the one case as in the other. It is also clear, if operated services; and that if effective control dictates certain rules of uniform accounting, these rules have the same force in either case.

In utility practice it is a first axiom that charges must cover costs, including operation, maintenance, management, capital charge and depreciation loss. Not only in their total but also in their allocation to different groups of consumers, charges must be adjusted equitably on this basis of cost. Both principles apply in full force to publicly operated services. Equitable allocation of cost to different consumer groups is vital to sound service administration, and such allocation in turn depends on true computation of full costs. But even apart from allocation, the growth of public services has so thoroughly established them in a position quite segregated from other elements of government that the principle of making rates which shall cover costs is today as axiomatic and

fundamental in publicly operated as in privately operated service. Proof, were any needed, can be found in the defective service of any city whose water department, let us say, is operated in disregard of this doctrine. In short, only by placing the public services on the same basis as utility service is it possible to have adequate check on efficiency, permanence and cost of service.

That the application of this principle would give immediate comparison of public and utility service costs is a secondary advantage. Lack of such comparison has caused many bitter disputes and many questionable intrigues. Propagandists for both sides claim that their respective systems operate more efficiently and economically, and both should therefore favor a cost and administrative system that brings the disputed points into clear light. To say the least, the questions at issue would be stripped of many useless elements of dispute and would narrow down to simpler underlying considerations. Beyond question, everyone who desires good government will be intensely interested if he should learn that publicly operated services are less efficient and more costly than utility services; the fact would work most powerfully toward better government.

In the matter of financing, the utility analogy is of equally constructive value to public administration of services. Under existing practice the financial system of governmental services is utterly confused. Capital and income funds are almost never segregated from the funds of general government. Financing, instead of being independent and self-contained, is merged with the general governmental credit operations, with the result that the credit of the service is never secure and the liability burden of the governmental unit is increased, to the injury of its credit. Similar shuffling of resources and obligations in private practice is perhaps not wholly unknown, but it is recognized as improper and harmful so well that the fight to put an end to it is making steady progress. There is good occasion for an equally determined fight on shuffling of public service funds.

With the growing cost of government, a growth which is proper and inevitable in view of the daily greater demands of convenience and service we place upon the community, control of the dead burden of taxation by full segregation of self-sustaining services is more and more imperative. And for the same reason the indebtedness of corporate government should be freed of the accessory liabilities of revenue service departments by segregation of finances and effective control of service and rates. Were these services placed unqualifiedly under regulatory commission control, in respect of quality, rates and finances, immediate gains of very large proportions would accrue to the public.

Utilities also have failed to make application of their analogy with public services. Many rules of practice established in public operations as necessary elements of honest and efficient service promise to be equally advantageous in utility operations. Open bidding for contracts and supplies, acceptance of low bid unless satisfactory reasons make another bid preferable, and freely competitive financing, are among these elements. All such expedients, developed to promote efficiency and check inside favoritism or grafting—whichever name be preferred—can bring as great return to the utility as to public service.

Full utilization of the analogy between public and utility services, we hold, offers possibilities for improvement of community service that have not yet been developed. The outstanding possibilities lie in the advance of the public services. Application of utility administration principles affords a prospect for raising the level of public services sufficiently to make a thoroughgoing change in many of the most troublesome problems now afflicting municipal government.

Next, Let Contracts

WITH the appropriation of more than a hundred million dollars for public-works acceleration a fundamentally important step toward unemployment relief and business reconstruction will have been taken. Alone, however, this one step is idle and valueless. It becomes effective only when the money is put to work. That is the next step.

The money is not meant to energize next summer's operations. Its big object is to make this a better winter, a winter when men will be working instead of idling. Every possible item of work that can be started now is wanted for this purpose. Contracts need to be let at once, not next spring. The eighty million dollar road loans to the states, the work on Boulder Canyon dam, the additional river and flood-control money, all these are operations to be put under way now. At best they can help only on a small scale; they cannot provide work for all who are now out of employment. The more reason for doing that little without delay, since what helps one will indirectly help many others.

Most or all of the work in question is such as would normally be let in spring. And because of this fact the agencies charged with utilizing the money will incline toward the usual procedure of planning, considering and preparing, with precaution and check and double-check. But this is not a normal occasion, and the money is not ordinary money. It is emergency money, for emergency times, and to use it effectively means emergency method and determination.

A contract in prospect is not a contract. It does not put orders on the books or call men back to the factories to make the supplies that must be ordered, or put men into the field. Road work that is to be let four months from now will not set in motion even preparatory operations, neither grading nor stockpiling nor even oiling up of equipment. It will have no value for the present or immediate future. It will leave the winter problem untouched.

Perhaps the business atmosphere in general will be made a little brighter with even such four-month prospect of contracts, now that the money is definitely in sight. It probably is true that public works can do very little in keeping the country's business alive. But that little, at least, should be done promptly, and no delays of leisureliness should be permitted to interfere with realizing all that it can contribute toward relief. If we must wait for reestablishment of a belief in business morals and in the soundness of banking and finance before private business activity is restored, let us not by procrastination delay the aid that emergency public-works construction can give.

These remarks address themselves to engineers and to administrative officials alike, but more especially to the former, the men of our own profession. Trained to faith in adequate preparation, they will see many obstacles to quick action, reason for requiring more time to draw plans, write careful specifications, and start with the season. But they are resourceful men, and can adapt their methods to emergency needs. Both in Washington and in the working regions of city and country, this is what the moment demands.

COMPOSITION OF EARTH DAMS

STABILITY of hydraulic cores of earth dams, long a subject of critical importance, is at present undergoing active investigation. During the past year or two interest in the subject has been intensified by slides and outbreaks at a number of dams, most prominently Table Rock, Alexander and Saluda. Full knowledge of current studies is, therefore, plainly imperative. In the following articles the results of three of these studies are presented. The first article outlines an investigation of the core of a seven-year-old hydraulic fill of the Miami Conservancy District. This is followed by a description of a practical means of controlling the composition of hydraulic-fill core materials. The series is concluded by an analysis of the mechanical composition of the materials of the major earth dams of the country, correlated with the service performance of the dams. In view of the construction of earth dams in constantly increasing numbers and dimensions, these facts and the conclusions drawn from them should be useful as a guide to those who plan similar structures.

Core Materials at the Germantown Dam

By C. H. Eiffert
Chief Engineer, Miami Conservancy District, Dayton, Ohio

DUE TO foundation conditions, earth dams were the only kind which could be used for the flood-protection works of the Miami Conservancy District. An examination of the materials available showed that hydraulic fill would be feasible and economical, and this method of construction was adopted. The borrowpit materials consisted of sand, gravel, till and clay; analyses made in the district's laboratory and by the Bureau of Public Roads showed that fine material of suitable quality was available in sufficient quantities to form satisfactory cores.

At three of the dams the principal method of construction was to excavate from the borrowpits with dragline excavators, load the material on dump cars and haul to a hog box or sump, from which the material was pumped to the dams, giants being used in the hog boxes to wash the material down to the pumps. At two of the dams a large proportion of the material was loosened by hydraulic giants and sluiced to the hog boxes, then pumped to the dams. At only one dam was it possible to sluice a considerable amount of material by gravity from borrowpit to embankment.

The cross-section of the cores in the dams is such that at any elevation the width is approximately equal to the height of the dam above that elevation; for instance, at a point 50 ft. below the top of the dam the core is 50 ft. wide. This gives an outside slope to the core of 2 on 1. This slope was thought to be sufficiently steep to prevent parts of the shell or outer section from caving into the core and to leave room for a sufficiently heavy shell within the outer limits of the dam to prevent hydrostatic pressure of the core from causing slides. During construction frequent tests were made with rods and iron balls to determine the consistency of the core material.

Pressure Cell Tests—Goldbeck pressure cells were installed to determine horizontal and vertical pressures of the core material. The results obtained from these cells were published in a paper by C. H. Paul (*Transactions*, Am. Soc. C. E., Vol. 85, p. 1,181). They were consistent, except in cases where damage occurred to the installations, and show the relation between horizontal and vertical pressures.

In Fig. 1 are shown the comparative results from cells in the Germantown, Taylorsville and Tieton (Wash.) dams. The data for Tieton dam were taken from an article by I. E. Houk in *Engineering News-Record*, Sept. 30, 1926.

This diagram shows the pressure lines all coming from the same point of origin, the horizontal scale showing pressures in pounds and the vertical scale distance from cell to pool level. This enables the reader to compare pressures for various depths in the three dams. The vertical pressures at Tieton were not used, as the article states they were not considered reliable due to the proximity of the cells to the concrete core wall, which affected the pressures after the core became partly solidified. For Germantown and Taylorsville, however, pressures in both directions are plotted. The connections to the cells at Taylorsville are still

THE GERMANTOWN DAM is one of the five retarding dams built in 1918-22 for the flood protection of Dayton, Ohio, and other cities of the Miami River Valley. The main dimensions and volumes of the five dams are as follows:

Name	Height, Ft.	Crest Length, Ft.	Volume, Cu.Yd.	Hydraulic Fill, Cu.Yd.
Germantown	114	1,200	835,000	800,000
Englewood	124	4,750	3,600,000	3,400,000
Lockington	78	6,400	1,000,000	795,000
Taylorsville	78	3,000	1,290,000	910,000
Huffman	73	3,600	1,396,000	1,396,000

The main features of the hydraulic-fill construction were described in *Engineering News-Record* of Sept. 9, 16 and 23, 1920, pp. 416, 547 and 601. A detailed report of all the flood-protection construction work was made by C. H. Paul, chief engineer, in *Technical Report X, Miami Conservancy District*, published in 1925.

accessible and in working order. Tests during recent years have shown no variation in pressure.

Composition of Earth Dams

Direct Examination—Near the close of the construction period, several opportunities were afforded to inspect the core materials in place. Two of these occurred at Lockington and Englewood, where the core pools accidentally overflow, cutting gashes in the sides of the dams through which all the water in the pools was discharged. The core material at that time showed considerable solidity; it resisted erosion and stood up nearly vertically in some places. At the Huffman Dam a temporary cross-dam was removed after draining the pool, and the core there (Fig. 2) showed conditions similar to those found at Englewood and Lockington.

At this time a number of samples were taken from the cores at Lockington and Englewood. These were obtained by digging into the banks a sufficient distance from the washout to make certain that the material had not been disturbed. The samples were secured by forcing a 7-in. length of stovepipe into the material The ends were then covered and soldered so that practically no moisture was lost. The moisture content of five samples taken at Lockington was from 21.8 to 22.6 per cent by weight. The moisture content of samples taken at Englewood was about 24 per cent and the weight per cubic foot about 121 lb. The Englewood Dam had been built up as much as 30 ft. in one month in the section where the break occurred.

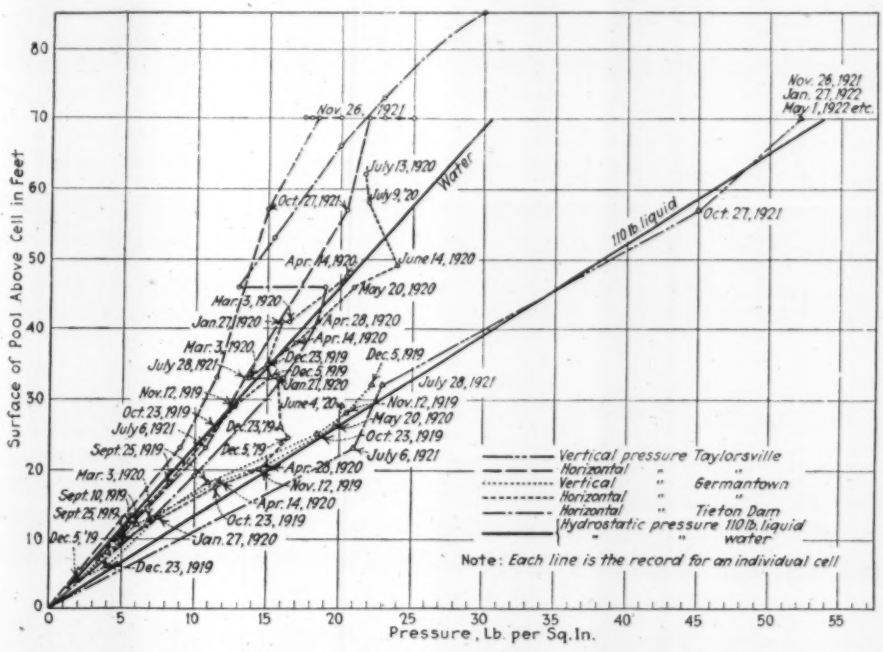


FIG. 1—RECORDED PRESSURES IN HYDRAULIC-FILL DAM CORES

Fig. 3 shows the nature of the core materials in the Miami Conservancy District dams as determined by analyses of the U. S. Bureau of Soils during the construction period. They are quite similar for the five dams. The results obtained in the recent Germantown tests should therefore be fairly typical of the other dams.

The tests reviewed showed that the cores of these dams did not long remain in a fluid or semi-liquid condition, but that they possessed consider-

FIG. 2—RELATIVELY SOLID CORE OF HUFFMAN DAM DURING CONSTRUCTION

able stability at the end of the construction period. As to what happened later there was much uncertainty.

To allay some of this uncertainty, explorations were made at the Germantown Dam in 1927, about seven years after its completion, to determine the nature of the core at that time. This work was done cooperatively by the Miami Conservancy District and the soils laboratory of the Massachusetts Institute of Technology, the field work being done by the district and the laboratory work by Glennon Gilboy, under Dr. Charles Terzaghi.

Core Exploration

It was decided to use two methods of exploring the core. One was to sink a shaft large enough so that men could work in it and so that the materials could be

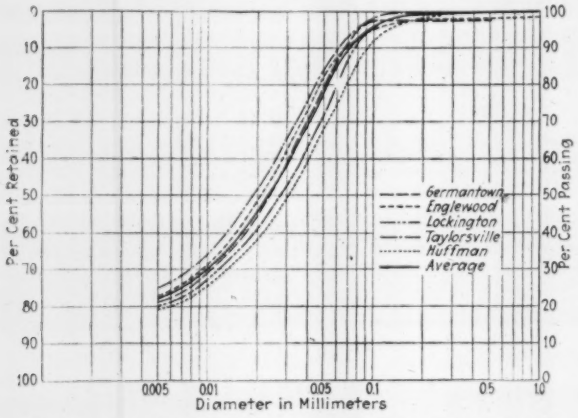


FIG. 3—ANALYSES OF CORE MATERIAL FROM MIAMI CONSERVANCY DISTRICT DAMS

inspected and sampled in an undisturbed condition. The other method was to sink an ordinary well casing and obtain samples by forcing a 2-in. sampling pipe into the undisturbed material below the casing. The latter method would of course be much cheaper, but there was some doubt as to samples being as satisfactory as those obtained from the shaft. By comparing the two kinds of samples in the laboratory this question would be answered.

Shaft Sinking—The shaft was located 12 ft. from the center line of the dam at a point where the height of the dam was 110 ft. A location over the center line of the dam and core would have been preferable but was considered impracticable on account of its obstruction to traffic on the highway across the dam. The shaft was made vertical with a circular concrete casing, having an internal diameter of 5 ft. and walls 5 in. thick. A sheet metal form, similar to those used for silos, was provided, and the concrete was poured in 3-ft. sections at the top of the dam. The casing sank under its own weight as the excavation proceeded. As there is no true core in the upper 15 or 20 ft. and as the shaft was located 12 ft. from the center line, the first core material was encountered at a depth of 33 ft. The first set of samples was secured at this depth.

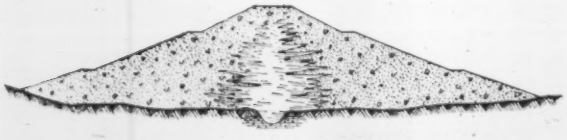


FIG. 4—SECTION OF A HYDRAULIC-FILL DAM
Note tongues of beach material extending into core.

The excavating for the shaft was done by hand by one man and the material elevated with a hand hoist and derrick. By lowering the boom it was possible to dump the bucket into a wagon beyond the shaft. The shed in which the materials, tools and samples were housed was so constructed as to act as a counterweight for the boom.

When the shaft had reached a depth of about 50 ft. the casing separated at one of the joints and it became necessary to reinforce it. The sinking process also became very slow and it was necessary to add weight. At a depth of 60 ft. it seemed impracticable to sink the casing farther, so a new one of smaller diameter was started inside of the first. This was sunk an additional depth of 20 ft. The inflow of water continued during all this time, and below a depth of 50 ft. it was necessary to supply air to the workman at the bottom. This was done by means of a small air compressor attached to the engine which ran the pump. Four good sets of samples were secured from the shaft and sent to the laboratory. The writer believes that if another shaft were to be sunk in materials similar to those at Germantown, it could be done very satisfactorily by the methods here described, but that the walls should be made 8 in. thick to give them additional weight for sinking and that they should be reinforced to prevent any separation at the construction joints.

Due to the fact that the shaft was located to one side of the center line, some of the upper core material was found to contain layers or tongues of fine gravel and sand. These contained a large amount of water, an unexpected but very interesting condition. This water was first encountered at 30 ft. below the top of the dam, and a hand pump was installed to remove it. As it continued to accumulate, a small gas engine and pump jack were added to operate the pump. It is the writer's opinion that this water is entrapped and held by the impervious core material adjoining and surrounding the tongues of sand, all of the tongues sloping downward toward the center of the dam. A better idea of this may be obtained from the sketch, Fig. 4. Some of this water probably remains from the construction operations. It has been augmented or maintained by the rainfall which has permeated the outer porous sections of the dam.

Some of the sandy tongues encountered extended across the shaft, and in order to determine whether or not they reached the center line of the dam 4-in. diameter horizontal holes were bored to follow out the two thickest ones. In both cases solid core material was encountered within a few feet of the shaft.

After completing the shaft a concrete slab with a manhole cover was placed over it. In the spring of 1930, two and a half years after the work was done, the shaft was inspected and found to contain water to a depth of 35 ft. The elevation of the surface of this water was 785. The maximum flood in the basin occurred in February, 1929, and reached El. 779.5. Therefore, no relation exists between the water in the shaft and the storage behind the dam.

Sampling Methods and Tools—In Fig. 5, *a* is a seamless steel sampling tube, 4 in. in diameter and 12 in. long, with one end turned down to a knife edge and this edge burnished inward 0.001 in. to give clearance to the sample. The tube, which had been wiped with an oiled rag before using to reduce friction on the inside, was forced into the core material by hand, the material around it being removed with a trowel as fast as the tube pene-

trated. As soon as the tube was filled it was carefully removed and the surplus material at the ends cut off by means of a fine wire in a hacksaw frame. Sheet metal caps (*b* in Fig. 5) were then placed over the ends and the sample brought to the surface.

Samples were taken in pairs at each location, one vertically and the other horizontally at right angles to the center line of the dam. On the work table were two circular iron bases ¾x4½ in. (*c* in Fig. 5). When a sample was brought up to be prepared for shipment, the iron base was covered with a thin layer of melted paraffin and the sample set vertically on it after the caps were removed. The steel tubing was then slipped from the sample. If it did not come off easily, a wooden disk slightly smaller in diameter than the tube was placed on top of the sample and held down while the tubing was pulled up off the sample.

A cylinder (*d* in Fig. 5), of 24-gage galvanized iron, 4½ in. in diameter, 13½ in. long, was then placed over the sample, the bottom sealed with modeling clay, and the space around and above the sample filled with melted paraffin. When the paraffin had hardened the cylinder was reversed, heat being applied to the iron disk if necessary to loosen it. The other end was then filled with paraffin. The entire sample was thus inclosed in paraffin, the structure of the sample and its water content being completely preserved for the laboratory.

Sinking Driven Well—The drillhole was located on the opposite side of the center line of the dam within about 25 ft. of the shaft. An ordinary well-drilling outfit was used, the pipe being 5⅝ in. in diameter. The work was done by a competent well driller, samples being secured under the supervision of employees of the district.

The sampling tools consisted of 24-in. pieces of 2-in. threaded seamless steel pipe (*e* in Fig. 5). The rod for lowering these samplers was of 1¼-in. pipe, to the lower end of which was attached a piece of 2-in. pipe about 2 ft. long. When a sample was desired the sampling tube was screwed into the lower end of the 2-in. pipe. After the hole had been carefully cleaned out with a dipper the sampling tool was lowered and driven into the core about 3 ft. This insured the complete filling of the sampling tube. The samples remained in these tubes for shipment, about ¾ in. of the sample being removed from each end and replaced with paraffin. The hole was driven to the base of the dam. Nine attempts were made to secure samples. Two were lost by slipping from the pipe and seven were satisfactory.

Study of Samples—The samples from both shaft and drillhole had the approximate consistency of stiff putty. The 4x12-in. samples would stand on end unsupported. Considerable pressure was necessary to indent them with the fingers. A number of samples of borrowpit material were also sent to the laboratory.

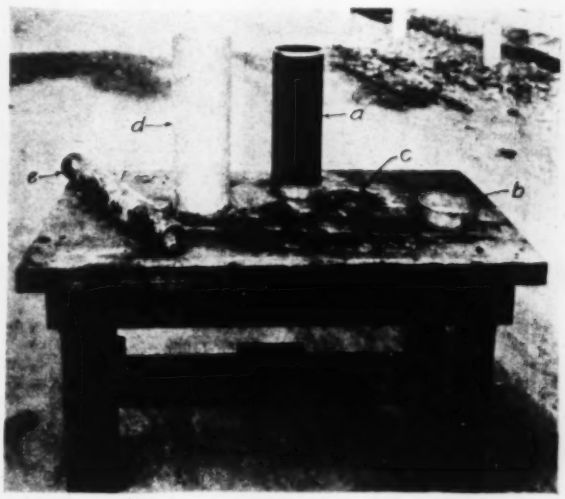
In the laboratory at the Massachusetts Institute of Technology mechanical analyses were made of the Germantown core, and samples were tested for permeability, compression, compressive strength, angle of internal friction, water content, and specific gravity. The technical details of these tests have been fully explained in a thesis by Mr. Gilboy. It was necessary to design a special permeameter, and a number of other pieces of apparatus were modified to meet the requirements better.

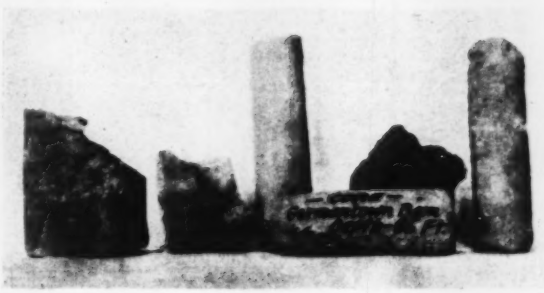
The mechanical analyses made were consistent with those made during the construction period. The average rate of permeability was found to be approximately 100×10^{-7} cm. per minute. This is equal to 0.00001 cm. per minute or 0.0144 cm. per day, a very low rate.

Tests for compression and compressive strength showed that the material possessed a high degree of stability. The friction angle in twelve tests varied from 24 to 32 deg., the average being 27 deg.

The water content, for a number of samples, expressed in percentage of dry or solid matter, averaged approximately 25 per cent.

The specific gravity was very accurately determined.





FIGS. 5 AND 6—SAMPLING EQUIPMENT AND CORE MATERIALS FROM GERMANTOWN DAM
See text for description of equipment. The samples had the consistency of stiff putty.

It was found to be 2.67 for the solid and 2 for the mass. This gives a weight of 125 lb. per cubic foot for the undisturbed core.

Conclusions

The following conclusions may be drawn as a result of the explorations and tests:

1. The samples obtained from the drillhole were fully as satisfactory as those from the shaft and were obtained at a much smaller expense.

2. The mechanical analyses show the core material to be well graded from fine sand to clay in such proportions as to make a very desirable combination. Examination also showed it to be practically free from flat particles which would increase its compressibility. The material is ideally adapted for a hydraulic-fill core.

3. The water content of 25 per cent is practically the same as that found at the end of the construction period at Englewood and Lockington. While the Germantown core was not tested for water content at that time, the

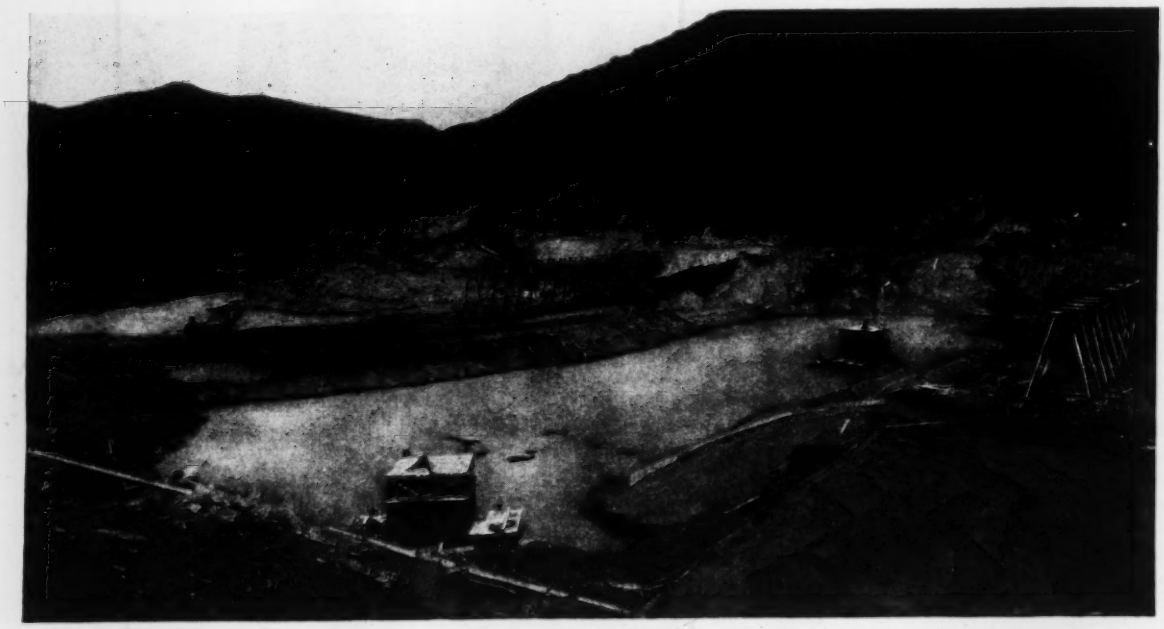
mechanical analyses show the materials to be quite similar. This would lead one to believe that there has been very little change in these cores since that time and that there is likely to be very little change in the future.

It is the intention to have these tests repeated at intervals in the future, so that any changes may be definitely determined. It is hoped that similar investigations will be made on other hydraulic-fill dams and that the scope of knowledge of this important subject may be increased to the end that better construction may result.

[*Composition of Earth Dams*]

Hydraulic-Fill Core Control

By Charles E. Waddell
Consulting Engineer, Asheville, N. C.



BEE TREE DAM, OF THE ASHEVILLE, N. C., WATER SUPPLY, UNDER CONSTRUCTION

Years of experience in dam construction led the writer of this article to the conclusion that core testing was too much a matter of personal equation; that a method, to be of much value, should eliminate the personal equation as far as possible; should be one that preserves the true size of the particles and their relative quantity without crushing or artificial manipulation; should be easily performed; and should make it possible to compare intelligently the core materials of different dams, built of different materials under different conditions. A test, to be of value, should make it possible to fix a mixture of maximum density, the smaller particles filling the interstices of the larger in the manner in which concrete is proportioned.

THE METHOD of core testing herein described was first used by the writer and his assistants on the Bee Tree Dam of the Asheville water supply, an earth and rock-fill dam 177 ft. high, with a volume of some 850,000 cu.yd., and built by the semi-hydraulic-fill process.

The Semi-Hydraulic-Fill Dam — Semi-hydraulic-fill dams are built by dumping dry materials on the upstream and downstream toes, filling the core space with water, usually designated the segregation pool, and, by means of hydraulic giants mounted on barges, washing the dry material to the center of the pool. The impinging jets create beaches; the material that flows to the center varies from large lumps and sometimes rocks at the beaches all the way to the finest of materials in the center. Current practice is to make the core about one-fifth the width of the dam. The core during construction is unstable and sensitive; movement of the material is uncertain and frequently unexpected.

FIG. 1 — EQUIPMENT FOR CORE SAMPLING UNDER WATER

In the segregation pool of a large dam, where materials of different colors have been dumped, a patch of color often appears on the still surface of the pool at a considerable distance from the point where the jet is working, indicating, of course, internal movement of the material. There is constant danger that a tongue of coarse material will form and build clear across the core; this, in its least harmful form, will cause seepage, and at its worst may cause the destruction of the dam.

Continuous and systematic testing of the core material should insure uniformity. Any departure from the predetermined constitution of the core is promptly detected by the laboratory tests and may be rectified by bringing in core material from

other borrowpits. The constitution of the core should be known at as many places as possible, and the test samples should be obtained in a way that positively fixes their location.

Composition of Earth Dams

Testing Equipment—The field equipment consists of a boat, a sampling pole, pint fruit jars and a jar crate, Fig. 1. The laboratory equipment consists of an electric oven, Fig. 2; a power-driven deflocculator and screens, Fig. 3; a microscope and chemical balances, Fig. 4; a centrifuge, Fig. 5; test tubes, 8-oz. baby bottles, etc.

Collecting Samples—When a dam is started data sheets like that shown in Fig. 6 are prepared and printed, and one sheet is made out and filed for each test. Samples are taken on lines perpendicular to the center of the dam, beginning at one end of the dam and continuing to the other; also to the right and left of the center line. Generally, the samples are taken 25 ft. apart, diminishing in distance as the dam rises and the segregation pool narrows. In every instance one sample is taken close to each beach and one from the center of the pool.

Fig. 1 illustrates the sampling pole. This device insures a true and representative sample at any selected point. As observed from the illustration, the pole is fitted with a bracket to hold a 1-pt. fruit jar. On the front of the pole is a rod which slides up and down and which is provided at the lower end with a stopper fitting the mouth of the jar. The pole is graduated in feet. Samples are taken from a boat. In taking the sample an empty jar is placed in the bracket and the mouth closed with the stopper. The pole is submerged in the segregation pool until the surface of the soil is felt; it is then pushed down about 1 ft., the stopper lifted by means of the rod, the pole gently agitated and the stopper replaced. The depth below the surface of the segregation pool is noted, and the location is spotted by the coordinates on the data sheet (Fig. 6). Since it requires the services of two men and a boat, it has been found convenient to collect and analyze eight samples at a time.

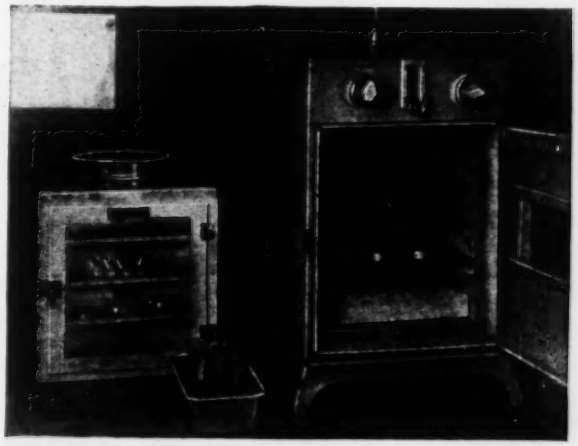
Laboratory Analysis—Samples are taken at once from the field to the laboratory, where the contents of the jar are thoroughly mixed, and a representative sample is removed and placed in a small aluminum pan. The pan is put in an automatic electric oven and dried at 220 deg. F. The cake is removed, put on a paper-covered board and gently rolled with a wooden rolling pin, using just sufficient pressure to break the cake without crushing the sand and gravel particles. The sample is next run through a 10-mesh screen to reject large particles, replaced in the pan and returned to the oven to remove any moisture that might have been absorbed. Ten grams of the sample are weighed out; the remainder is put in a paper bag, labeled with number and date and stored.

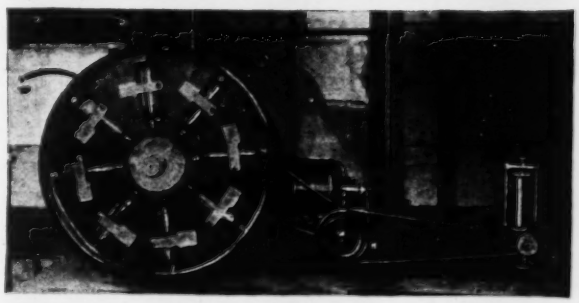
An analysis is then made to obtain the percentages of materials composing the samples and is classified as:

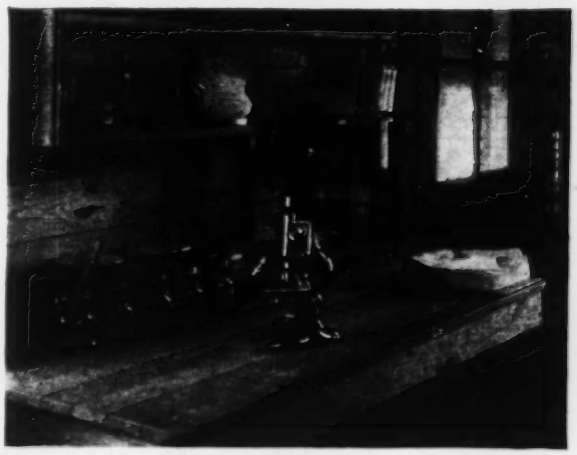
	MM.	
Fine gravel	2.0	1.0
Coarse sand	1.0	0.5
Medium sand	0.5	0.25
Fine sand	0.25	0.10
Very fine sand	0.10	0.05
Silt	0.05	0.005
Clay and colloids	0.005	0.000

Deflocculating—The 10-gram sample is placed in an 8-oz. glass bottle with 1 c.c. of strong aqua ammonia, and the bottle is filled with clean water to the 2-oz. mark. The bottles used are small-necked baby bottles graduated in ounces. Eight bottles containing samples are next placed in the deflocculating machine and run for seven hours at 60 r.p.m. This process, aided by the ammonia, separates the particles.

Microscopic Test—At the end of seven hours the bottles are removed from the deflocculator, placed in the rack in an upright position, and the stoppers are removed, care being exercised not to lose any particles adhering to them. The contents of the bottles are agitated by a small water jet under pressure and allowed to settle, the time being determined by microscopic observations. The time of settlement is determined by removing a few drops of water every 15 sec. and examining under the microscope until all particles larger than 0.5 mm. have settled.







FIGS. 2-4—LABORATORY APPARATUS
Top—electric oven.
Middle—deflocculator and screens.
Bottom—microscope and chemical balance.

Next, the water is decanted into a glass beaker, leaving the heavier material in the bottle. The material remaining in the bottle is again agitated with the water jet and again decanted into the same beaker; this process is continued until the water is clear.

Drying and Screening—The liquid in the beaker contains silt, clay and colloids; the material left in the bottle is sand of various sizes. The sands remaining in the bottle are then further elutriated and poured into a glass test tube. As soon as the materials settle, the water is poured off and the test tube placed in the oven to dry. When dry the material is placed in the top compartment

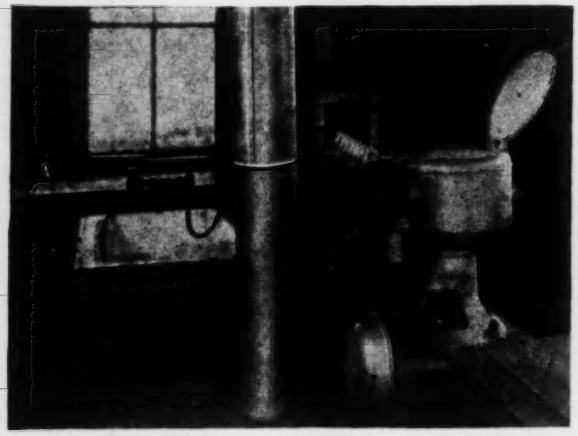


FIG. 5—CENTRIFUGE WITH LID RAISED

of a nest of screens, and the screens are placed in a power-driven shaker and run for five minutes. The material remaining on each screen is weighed in a chemical balance and the weight entered on the data sheet. The water containing the silt, clay and colloids is poured into a test tube and run in a centrifuge. The speed and time of centrifuging are determined by the microscope,

SAMPLE NO. ..... LABORATORY NO. .....

DATE ..... CHARACTERISTIC ..... ELEVATION .....

MECHANICAL ANALYSIS

CLASSIFICATION	SIZE IN MM.	WEIGHT IN GRAMS	PERCENT OF SAMPLE	REMARKS
Fine Gravel	2.0 TO 1.0	.071	0.71	100.00
Coarse Sand	1.0 TO 0.5	.130	1.30	99.29
Medium Sand	0.5 TO 0.25	.561	5.61	97.99
Fine Sand	0.25 TO 0.10	3.180	31.80	92.38
Very Fine Sand	0.10 TO 0.05	1.507	15.07	60.58
Silt	0.05 TO 0.005	2.546	25.46	45.51
Clay	0.005 TO 0.001	2.005	20.05	
Colloids	0.001 TO 0.000			

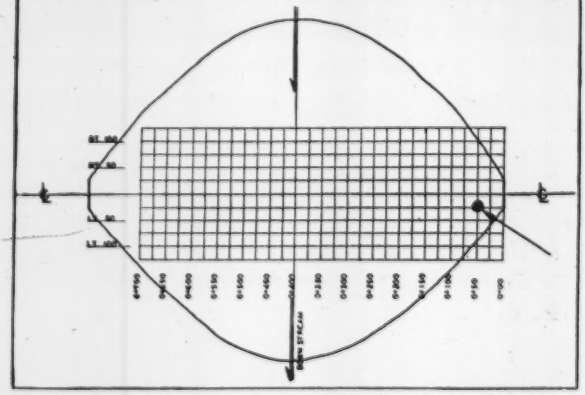


FIG. 6—CHART FOR RECORDING DETERMINATION FROM SAMPLE

and are such that particles 0.005 mm and smaller remain in suspension, while larger particles are thrown to the bottom of the tube. After centrifuging, the water in the test tube which contains the clay and colloids is poured off without disturbing the silt in the bottom of the tube. Test tubes are then dried in the oven and the silt is weighed and entered on the data sheet. The weight of the clay and colloids is found by subtracting the weight of the other six grades from the weight of the original sample.

Recording the Results—First, the quantities are recorded on the data sheet, Fig. 6; the spot from which the sample was taken is noted by the coordinates; the serial number of the sample is noted; also the elevation at which the sample was taken. Next, the position and number of the sample is noted on a cross-section drawing

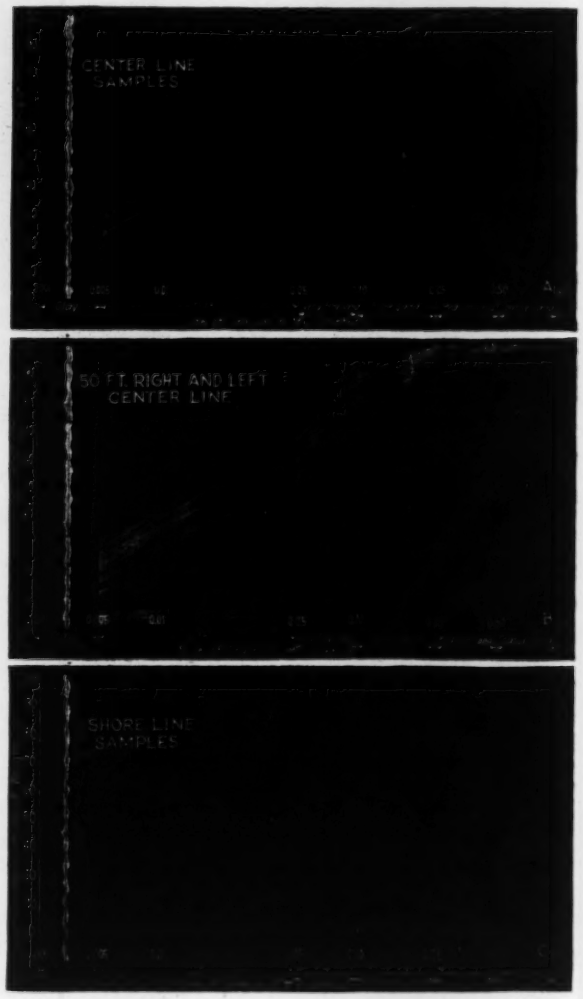


FIG. 7—GRAPHS OF TEST RESULTS PLOTTED FOR THREE POSITIONS ACROSS CORE SECTION

of the dam (not illustrated). Lastly, the test is plotted on a chart such as those illustrated in Fig. 7.

The lines are superimposed one over the other and frequently cross one another. The density of the chart conveys a picture of the constitution of the core. The three charts exhibited indicate, as stated on their faces, the composition of the core at the center, 50 ft. each side of the center, and at the shore lines.

The materials with which we have had the most experience are the clays and disintegrated gneisses of the

southern Appalachians. Experience seems to indicate that the most impervious core is obtained when the particles 0.005 mm. and smaller constitute some 15 or 20 per cent of the mass.

[*Composition of Earth Dams*]

We have found the composition of the core is best observed by placing a large-size sample in a quiet place and allowing it to dry out naturally, the time usually running into weeks, if not months; then breaking it and examining its cross-section. Since the core is subjected to enormous pressure, this probably does not represent the true condition that obtains, but it does convey some idea of the density, and the samples which we have tested in this manner have many of the characteristics of a piece of very soft bituminous coal.

In conclusion, the writer desires to acknowledge the helpful suggestions of Dr. R. O. E. Davis, formerly of the faculty of the University of North Carolina, now with the U. S. Bureau of Soils; the design of the sampling rod by E. M. Jones, resident engineer, Bee Tree project; the design of the deflocculator by his assistant, Raymond J. Rosenberger, and the painstaking and diligent work of Clyde Hoey, Jr., laboratory technician.

Materials in Existing Earth Dams

By E. W. Lane

Research Engineer, Bureau of Reclamation, Denver, Colo.

Current Studies of earth-dam materials by the Bureau of Reclamation depend for their ultimate completeness on the cooperation of other engineers in furnishing data to be added to those already collected. Publication of the results of the investigation to date is intended to encourage such cooperation. Further results are to be published in papers similar to the following. In view of the great value of such information to the entire profession, the assistance requested should be tendered promptly and wholeheartedly.

IN ORDER TO put the selection of suitable material for earth dams on a more scientific basis the U. S. Bureau of Reclamation is investigating the materials of existing and proposed dams. Thorough search has been made in available literature, the bureau files and other sources for mechanical analyses of earth-dam materials. This has resulted in a collection of data on the composition of quite a number of dams, to which has been added what is known about the history of the dams during and following construction. In order to utilize this information on a current project, although the investigation has not yet been completed, it was analyzed and tentative conclusions were drawn as to the limits of the mechanical composition of material suitable for construction of earth dams by various methods.

The dams were divided into two groups: rolled-fill and hydraulic, including semi-hydraulic. Nearly all of the available mechanical analyses fall into one of three classes: (1) material for rolled dams, usually the analyses of samples from borrowpits; (2) borrowpit materials for hydraulic or semi-hydraulic dams; and (3) core materials of hydraulic and semi-hydraulic dams.

Rolled Dam Materials

Table I gives some of the data on rolled dams, together with the source of information from which the mechanical analyses were obtained. The analyses are plotted in Fig. 1. This diagram shows that a wide range of materials has been used in earth dams with apparent success. The data at hand do not indicate any lower limit to the grain size of material suitable for rolled construction. In fact, some dams have been successfully built with large proportions of clay.

If the term clay used in the descriptions of these dams is the same as that used in the Bureau of Soils classification, these dams are composed of much finer material than anything shown on the diagram. Steps are now being taken to secure samples of material from existing successful dams said to have a high clay content. It is probable, however, that the term clay as ordinarily used differs considerably from the standard used on the chart. For example, the three samples averaged to obtain line 2 on the chart, representing the composition of Table Rock Dam material, were all described as clay, although the average analysis shows only about 7 per cent of clay as defined by the Bureau of Soils.

Sufficient knowledge of the materials represented by the analysis curves is not at hand to determine whether or not the mechanical analyses will throw any light on some properties of the material which affect their suitability as rolled dam materials, such as ease of compacting, tendency to stick to the roller and to slough when saturated. The mechanical analysis cannot, therefore, be taken as the only criterion of suitability. It obviously cannot indicate the presence of soluble substances in the dam material.

The diagram does give a rough indication of the maximum size of materials suitable for the impervious portions of earth dams. Line 16 shows the composition of the material comprising the foundation and lower part of the Mackay Dam. This dam leaked so much that construction was abandoned for a time. It was later increased in height, apparently with the same material, and at times the flow through the dam and foundations

TABLE I—DATA ON ROLLED-FILL DAMS

Dam	Location	Condition	References
Point of Rocks	Colorado	Not known	*Eng. Rec.*, July 15, 1911, p. 72.
Table Rock*	South Carolina	In use	*Eng. News-Rec.*, July 26, 1928, p. 147
Schofield or Pleasant Valley†	Utah	In use	*Eng. News-Rec.*, May 24 and 31, 1928, pp. 827, 864 and 872, also Dec. 20, 1928, p. 915 Analysis from Reclamation Bureau records
Red Butte Canyon	Utah	Under construction	Data from Reclamation Bureau records
Cle Elum	Washington	Construction authorised	
Hyrum	Utah	Proposed	
Echo	Utah	Under construction	
Lahontan	Nevada	In use since 1915	
Rock Canyon‡	Colorado	Constructed, 1925	Data from *Colorado State Engineer*
Cold Springs	Oregon	In use since 1908	*Eng. News*, March 7, 1907, p. 250; *Trans.* Am. Soc. C. E., Vol. 74, 1911, p. 43
Mackay§	Idaho	In use	*Trans.* Am. Soc. C. E., Vol. 81, 1917, p. 1. *Eng. News-Rec.* April 26, 1923, pp. 745 and 934

*Partial failure, not due to character of earth used, which was very satisfactory.
†Partial failure, not due to quality of earthfill.
‡Flood control, no water stored yet.
§Leaked very badly.

amounted to as much as 30 sec.-ft. This material is, therefore, definitely too coarse for rolled construction.

Composition of Earth Dams

Line 9 shows the composition of the downstream portion of the Lahontan Dam, which was composed of clean, well-graded gravel. The material comprising the upstream portion of the dam (line 8) was composed of a 50:50 mixture of this gravel and silt. Extensive tests of the seepage rates through the two classes of material showed that the 50:50 mixture permitted only 1/3,000 as much flow as the gravel. Since the Lahontan Dam has been in use about fourteen years and has not shown an undesirable amount of seepage, it may be concluded that the 50:50 mixture represented by line 8 is suitable for the impervious sections of earth dams, and that the gravel shown by line 9, which allows 3,000 times as much water to pass through and is very similar to the Mackay Dam material, would not be suitable.

Experiments were also performed on the material of the Cold Springs Dam. Line 15 represents the material (all gravel) of the downstream part of the dam. This material permitted even more seepage than that shown by line 9, and would therefore represent too coarse a material. Line 14 shows material composed of 80 per cent gravel and 20 per cent fine surface soil, which permitted about 1/2,200 as much flow as that of line 15. Line 13 is for a material composed of 75 per cent gravel and 25 per cent fine soil, which permitted a flow of about 1/5,000 that of the gravel alone. These materials are believed to be about the limit of material suitable for the impervious sections of rolled-fill dams.

The line in Fig. 1 labeled "Approximate limit of materials suitable for impervious sections of rolled-fill dams" is somewhat arbitrarily drawn, representing an effective size of 0.15 mm. and a uniformity coefficient of 40. This line represents materials finer than the gravels shown by line 16, the Mackay Dam, and lines 9 and 15, composing the downstream sections of the Lahontan and Cold Springs dams, respectively, which were shown to be too porous. It shows coarser materials than line 8, the upstream section of Lahontan Dam, and about the same gradation as lines 13 and 14, which represents the top center and downstream center sections of the Cold Springs Dam, which are believed to represent about the upper size limit of suitable materials if a reasonably watertight dam is to be secured.

For the porous material frequently used in the downstream sections of dams to secure stability and drainage there is no need of prescribing a limitation, for these parts may be and frequently are rockfill and include boulders of considerable size. The line given on Fig. 1 does not represent a fixed limit beyond which a safe dam cannot be built, but is believed to represent approximately the limits of material which can be used with the ordinary cross-sections to secure a dam without objectionable seepage. Although the data collected are not sufficient to establish it, it is probable that the gradation of the material is important, and that a material of more uniform size than that shown by the limiting line would require a higher proportion of fine material to be satisfactory, since with a well-graded mixture the fine material better fills the voids in the coarse and makes a more impervious mixture.

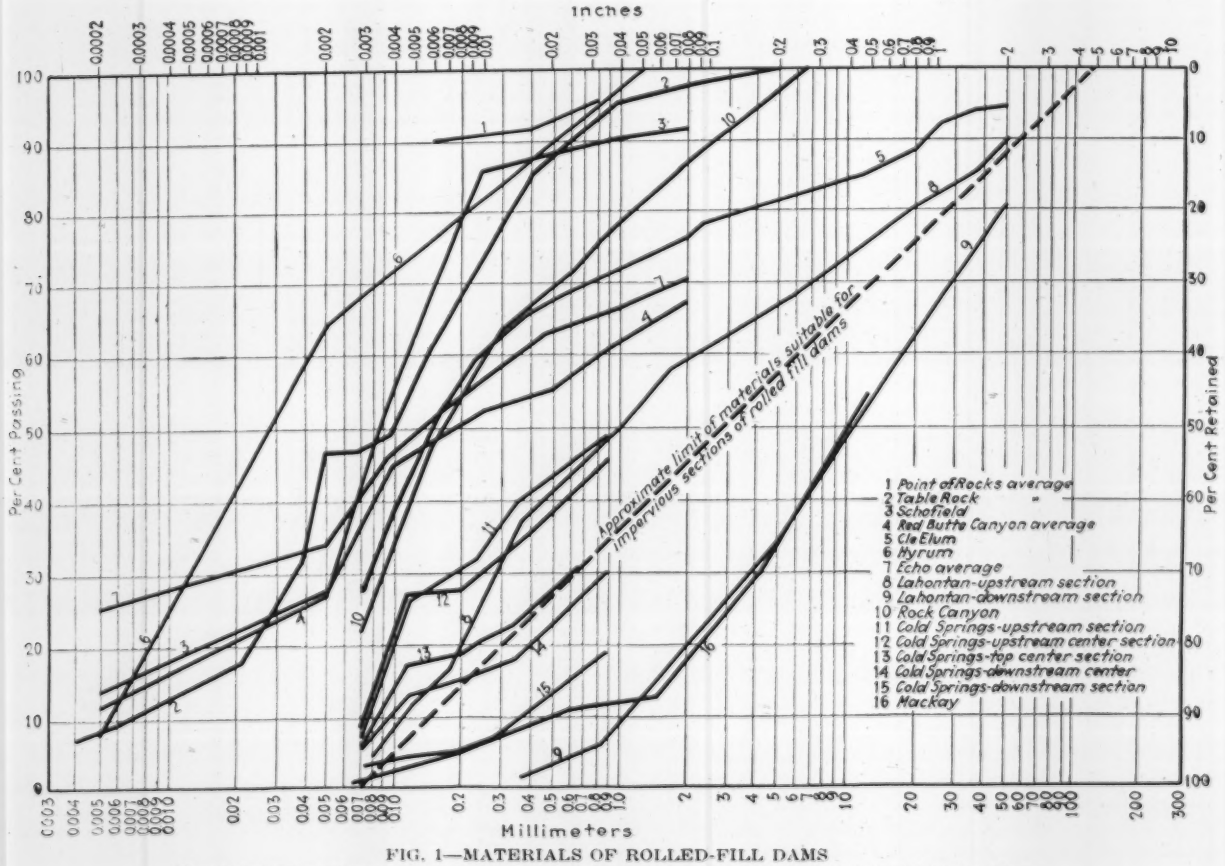


FIG. 1—MATERIALS OF ROLLED-FILL DAMS

Upper size limit suggested is somewhat coarser than the upstream material of the Lahontan Dam.

Composition of Earth Dams

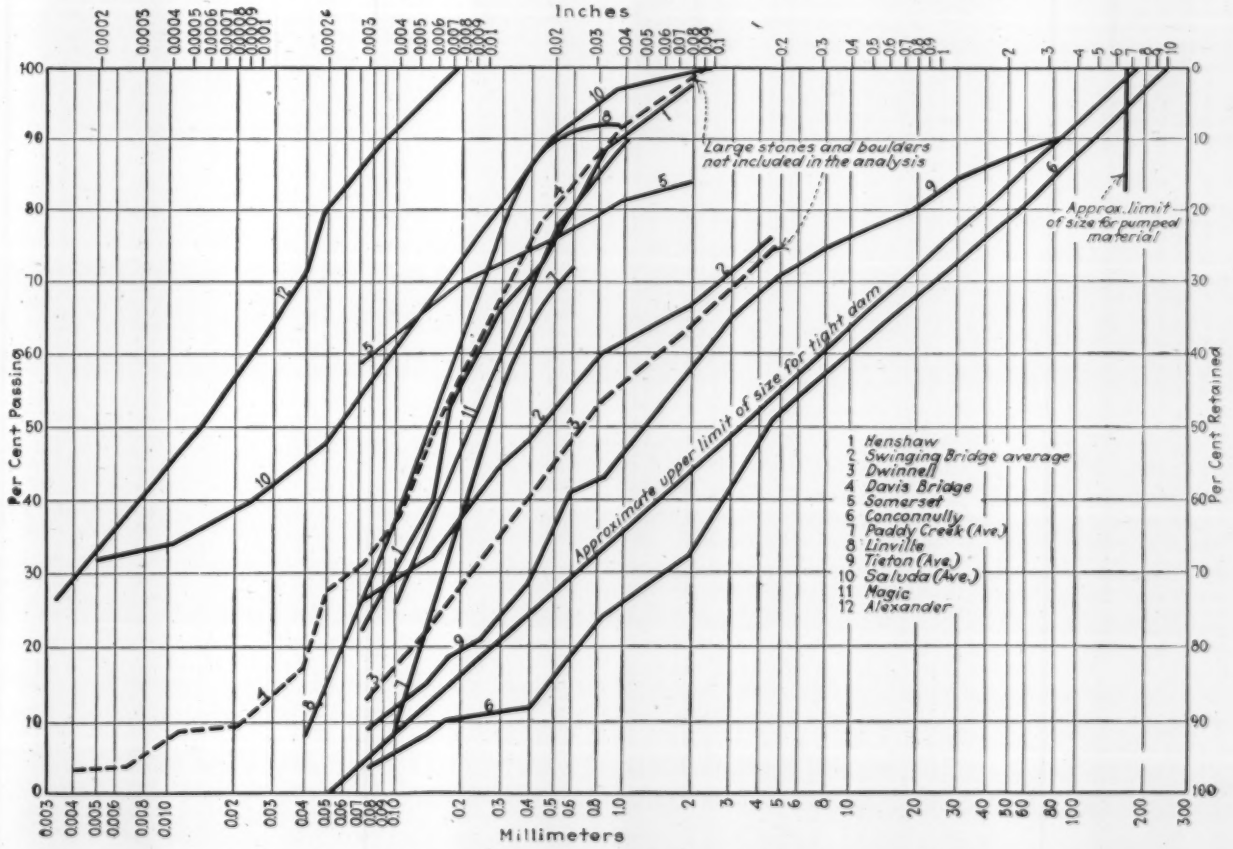
Fig. 2 shows that a wide range of material has been used successfully for hydraulic and semi-hydraulic-fill dam construction. By hydraulic-fill dams is meant those in which the earth is both transported to the dam and placed by the agency of water, while in semi-hydraulic fills the material is hauled by mechanical means and placed hydraulically. The data available are not sufficient to show any differences in the requirements of material suitable for these two types of construction, and they have therefore been plotted on one diagram.

Certain differences do exist, however. The maximum size of particle which can be handled by the hydraulic method is limited by the size of the pump openings. On the Miami Conservancy project stones over 6½-in. diameter were screened out. Larger material is frequently used in semi-hydraulic fills. If there is a deficiency of fine material, a greater proportion of the fines coming from the borrowpit can be placed in the core by the hydraulic method than can be washed out of the material after it is dumped on the dam from cars in the semi-hydraulic process, since in the hydraulic process, after the material passes through the flumes or pipes, the fines are in suspension and do not deposit readily except in the core pool. On the other hand, finer material can be used in a semi-hydraulic fill than in a hydraulic fill, since a part of the fines can be allowed to remain mixed with the coarser material in the outer section of the dam.

No lower limit has been set for suitable borrowpit material for dam construction by the hydraulic processes, as it is hoped that data will soon be available to define this limit more accurately. No difficulties were reported at any of these dams except at the Saluda and Alexander dams. At the former a small slip occurred, and a considerable quantity of earth was washed out by the water from the pool, which was unusually large because of the great length of the dam. The slip is said to have been due to raising the segregation pool too high, allowing the water to escape in the downstream dike at the top of the pool. At the Alexander Dam a large slide took place during construction, the action being apparently quite similar to that at Saluda.

In the case of the Swinging Bridge and Henshaw dams (lines 2 and 1) those in charge of construction believed the borrowpits to contain too much fine material, and some was wasted. At the Taylorsville Dam (not shown on Fig. 2) 60 per cent of the material was retained on a 100-mesh sieve, and considerable of the finer material was wasted. On the other hand, at the Somerset Dam, whose borrowpit material was much finer than any of the three just named, an effort was made to retain all the fines, alum being used to settle out the very fine particles. The experience with this dam described in *Engineering News-Record*, Nov. 14, 1929, p. 769, indicates that a dam can be built of very fine material under certain conditions. The fineness of the material allowable is influenced somewhat by the rate of construction. The decision to waste fine material in the case of the Henshaw Dam was influenced by the fact that the dam was to be built very rapidly.

Wasting material from the core of hydraulic-fill dams has two effects. It increases the size of particle, since



Upper size limit is between the material used in the Tieton Dam and that of the Conconnully Dam.

FIG. 2—BORROWPIT MATERIALS OF HYDRAULIC-FILL DAMS

the coarser particles settle while the finer ones, especially the colloids, pass out with the waste water. The core, being composed of coarser material, settles and consolidates more rapidly and therefore is less likely to exert dangerous lateral pressures. Wasting fines also decreases the width of the core. A wide core, unless it consolidates very rapidly, is a menace during construction, because the outer shell of the dam overhangs and partly rests on the unconsolidated core, which may be too unstable to support the weight. The more nearly vertical the division line between the core and the outer shell the less danger of sloughing from this cause. It is probable that cores of great width where the outer shell rested upon unconsolidated material have been as much responsible for the failure of hydraulic-fill dams during construction as has the nature of the core material.

The danger to dams built by hydraulic processes from the use of fine material seems to be confined to the construction period. So far as is known, no hydraulic or semi-hydraulic fill dams have proved to be unstable after construction was completed. Although the experience at Somerset indicates that dams using fine material can be constructed without accident and materials similar to those used in the Alexander Dam are said to have been successfully used in other hydraulic-fill dams in the Hawaiian Islands, the experience at Saluda and Alexander indicates that considerable risk is involved in the use of fine materials in the hydraulic construction process and that they should be used with extreme caution until more definite knowledge is available to indicate just what constitutes satisfactory material.

To indicate roughly the maximum size of material which will make a tight dam, a line has been drawn on Fig. 2, labeled "Approximate upper limit of size for tight dam." This line is somewhat arbitrarily drawn, having an effective size of 0.12 mm. and a uniformity coefficient of 60. This places it finer than the Conconnully Dam, line 6, which permits considerable seepage, although not enough to endanger the structure. This dam was built in 1910, when the construction of hydraulic-fill dams was not so well understood as it is now, and the core is comparatively thin. The Tieton Dam, line 9, contains a concrete core wall, and the fact that it is practically watertight does not prove that the puddle core itself would be sufficient. The Dwinnell Dam, line 3, was constructed of coarse material. Before construction it was expected that the volume of fine material would be insufficient, but this was not found to be the case. It is probable, therefore, that this dam represents about the upper limit of material suitable for a hydraulic-fill dam. The analysis shown by line 3 does not include the large stones and boulders; if these were included, the proportion of these larger particles, as judged from a photograph of a dam, would be sufficient to cause the line to fall fairly close to the limit set.

The positions of the limiting lines for coarse materials for hydraulic fill and rolled fill are shown by a comparison of Figs. 1 and 2 to be very similar. As was remarked in the discussion of rolled-fill dam material, the limiting line shown for the hydraulic processes should not be regarded as an absolute limit but as an approximate relation applying to dams of ordinary cross-section.

Hydraulic-Fill Core Material

Considerable data were secured on the composition of the core material of hydraulic-fill and semi-hydraulic-fill dams. In Fig. 3 the analyses are shown graphically. The materials of successful dams vary over a wide range, the finest showing 30 per cent coarser than 0.0055 mm., and the coarsest 50 per cent larger than 0.35 mm., or a size ratio of 1 : 64.

Available evidence indicates that size of particle is not the only factor in suitability of core material from the standpoint of rate of consolidation. Some core materials consolidate very slowly, while others equally fine reach a stable condition soon, but from the data so far available the factors causing this difference cannot be determined. The core of the Calaveras Dam, line 16, consolidated very slowly, and a failure from sloughing resulted. The Wichita Falls core, however, which is also very fine, consolidated at so rapid a rate that the dam could be constructed with unusual speed. The Alexander Dam failed during construction, but the core material showed considerable stability in the part which did not move. Although further study may prove that the size of particle is not the controlling factor in the

TABLE II—DATA ON HYDRAULIC AND SEMI-HYDRAULIC-FILL DAMS

Dam	Location	Type	Condition	References
Henshaw	Calif.	Hydraulic	Built in 1923	*Eng. News-Rec.*, Aug. 30, 1923, p. 342
Swinging Bridge	N. Y.	Hydraulic	Recently const.	*Proc.*, Boston Soc. C. E., May, 1929
Dwinnell	Calif.	Hydraulic	Recently const.	*Western Con. News*, Feb. 25, 1929, p. 96
Davis Bridge	Vt.	Semi-hyd.	In service since 1924	*Water Works*, Mar. 1925, p. 505; *Eng. News-Rec.*, Nov. 14, 1929, p. 770
Somerset	Vt.	Semi-hyd.	In service since 1913	*Eng. News*, June 4, 1914, p. 1,236; *Eng. News-Rec.*, Nov. 14, 1929, p. 770; *Trans.* Am.Soc.C.E., Vol. 84, 1921, p. 331
Conconnully	Wash.	Hydraulic	In service since 1910	*Trans.* Am.Soc.C.E., Vol. 74, pp. 64 and 72; *Eng. Rec.*, April 3, 1909, p. 370
Paddy Creek	N. C.	Semi-hyd.		*Trans.* Am.Soc.C.E., Vol. 84, 1921, p. 331
Linville	N. C.	Semi-hyd.		*Trans.* Am.Soc.C.E., Vol. 84, 1921, p. 345; Hydro-Elec.Handbook, Creager and Justin, p. 249
Tieton	Wash.	Semi-hyd.	In service since 1925	*Eng. News-Rec.*, Sept. 30, 1926, p. 544; also Bureau of Reclamation records
Saluda	S. C.	Semi-hyd.	Under constr.	Data from Albert S. Crane
Magic	Idaho	Semi-hyd.	Built in 1909	"Hydro-Elec.Handbook," Creager and Justin, p. 249
Germantown*	Ohio	Hydraulic	Completed about 1921	*Trans.* Am.Soc.C.E. Vol. 85, 1922, p. 1,181
Eaglewood*	Ohio	Hydraulic		
Lockington*	Ohio	Hydraulic		
Taylorsville*	Ohio	Hydraulic	Completed about 1921	*Trans.* Am.Soc.,C.E., Vol. 85, 1922, p. 1,181
Huffman*	Ohio	Hydraulic		
Alouette	B. C.	Semi-hyd.	Completed about 1926	*Eng. News-Rec.*, April 29, 1926, p. 696
Calaveras	Calif.	Hydraulic		"Hydro-Elec. Handbook," Creager and Justin, p. 249
Soft Maple	N. Y.	Hydraulic	Completed about 1925	*Eng. News-Rec.*, Jan. 29, 1925, p. 180; data from W. P. Creager and Albert S. Crane
Sherman	Mass.	Semi-hyd.	In service since 1927	*Eng. News-Rec.*, April 28, 1927, p. 681
Terrace	Colo.	Hyd.-fill		*Eng. Rec.*, Vol. 64, July 15, 1911, p. 72
Bee Tree	N. C.	Semi-hyd.		Data from Albert S. Crane; *The Excavating Engr.*, March, 1927, p. 89
Blue Ridge	Tenn.	Semi-hyd.	Under const.	Data from Albert S. Crane
Wichita Falls	Texas	Hydraulic	Completed 1923	Data from A. S. Fry and *Eng. News-Rec.*, Dec. 20, 1923, p. 1,004
Alexander	Hawaiian Islands	Hydraulic		Data from Joel B. Cox and *Eng. News-Rec.*, Vol. 104, pp. 665, 703, 869; *Hydro-Engr.*, Dec. 1929

*Flood-control reservoir.

suitability of core material, available data indicate that all dams with which difficulty was experienced during construction had fine cores, and therefore fine materials should be used with caution until more is known of the underlying principles controlling the action of earth-dam materials.

The Calaveras Dam was built prior to the construction of most of the other dams shown, and its failure, together with that at Necaxa, caused the constructors of a number of dams to waste some of the fine material from their cores. This is particularly true of the Taylorsville Dam, line 9. Fines were also intentionally wasted at the Swinging Bridge Dam, line 14, and the Henshaw Dam, line 12. In the latter case the core material was quite coarse, but this was believed to be necessary to secure consolidation of the core at a sufficient rate to permit rapid construction. Some of the fines were also allowed to escape from the Wichita Falls Dam. All the fine material was retained at the Somerset Dam (line 20), at Saluda (line 1), and at Alexander (line 22).

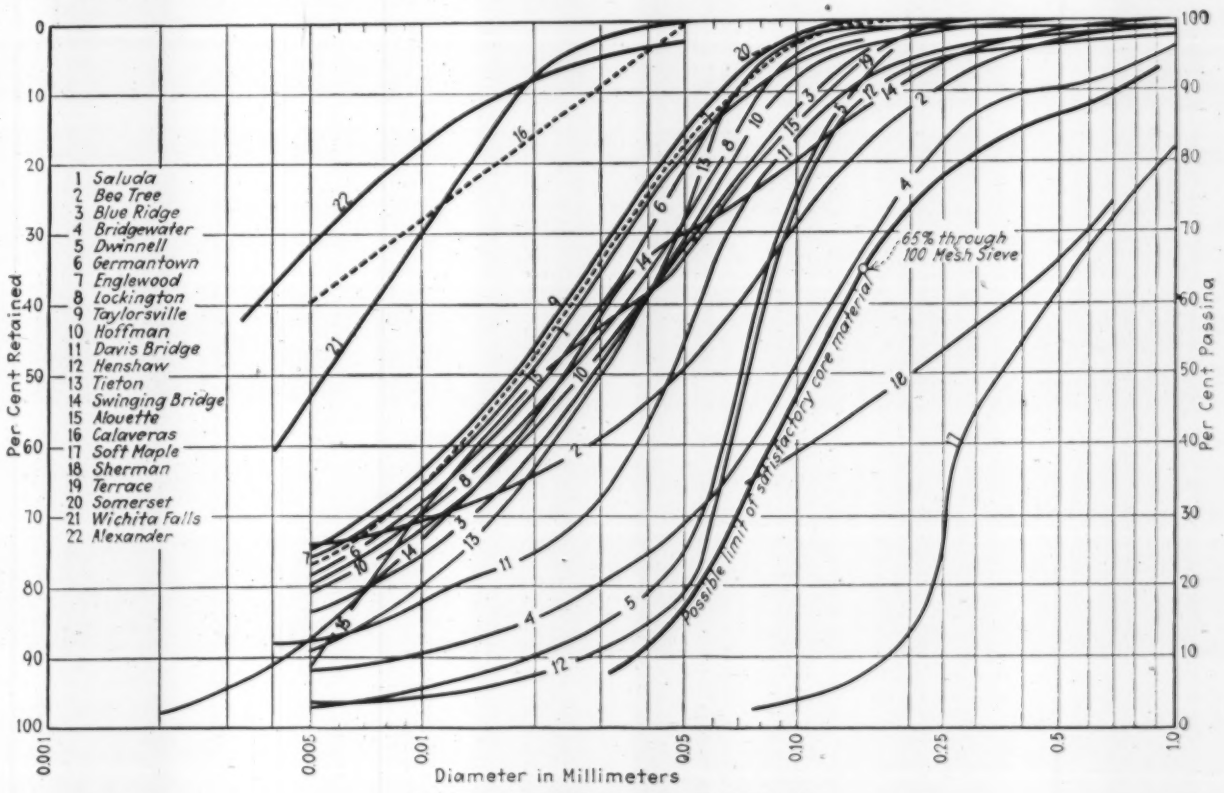
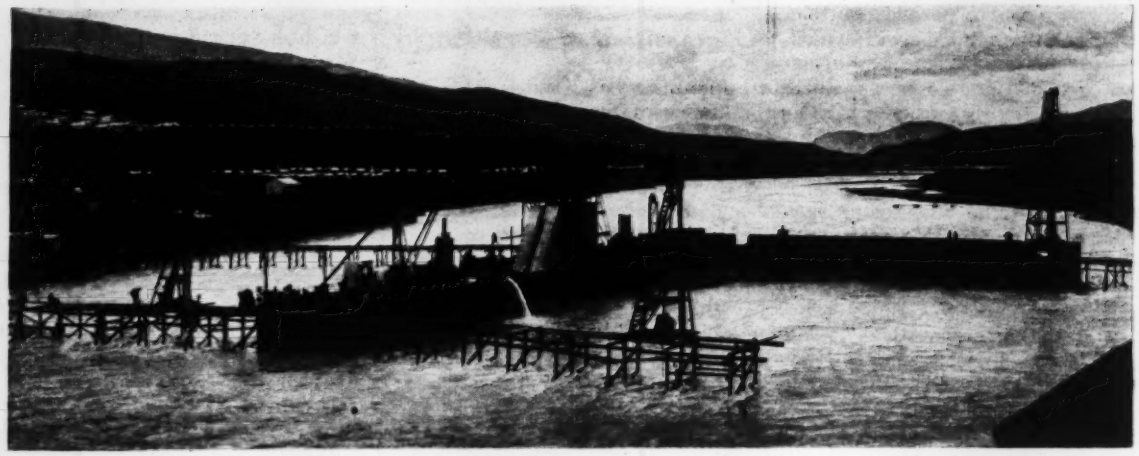


FIG. 3—ANALYSES OF CORE MATERIALS
Upper size limit is close to that of material of Bridgewater Dam.

No data are available to show the upper limit of core material sizes from the standpoint of safety of the dam, but as the material reaches a certain size seepage through the dam begins to assume undesirable proportions, if the dam is of customary cross-section. The Soft Maple Dam, line 17, was built of nearly pure sand and showed considerable leakage. As the water passing through is perfectly clear, however, no concern is felt for the safety of the dam. The line labeled "Possible limit of satisfactory core material" is drawn passing through the point representing 65 per cent passing a 100-mesh sieve, and below the lines for the Bridgewater Dam (line 4), the Henshaw Dam (line 12), and the Dwinnell Dam (line 5), all of which have satisfactory cores. Information is not available on the results at the Sherman Dam, line 18. According to Albert S. Crane, who has had extensive experience with hydraulic-fill dams with cores ranging in fineness from that at Saluda to that at Soft Maple, "Almost any material of which 65 per cent passes a 100-mesh sieve makes a satisfactory core." It is therefore believed that in at least some cases cores coarser than this have been found to be unsatisfactory, and the line is drawn through this point, although the results at the Sherman Dam, line 18, may have been satisfactory. Mr. Crane also states that of the dams with which he has been connected, the composition of the Bridgewater Dam, line 4, is the best.

As has been stated, the Bureau of Reclamation is continuing its studies along these lines and expects to be able to obtain data on permeability and mechanical composition of the material composing a number of other dams, with some of which difficulties have been experienced. The bureau will be very glad to receive from interested engineers data on this subject which they may have collected and will be glad in return to keep them informed regarding the progress of its studies.

This study of dam material was made in the Denver office of the Bureau of Reclamation, under the direction of J. L. Savage, chief designing engineer, and R. F. Walter, chief engineer. All activities of the bureau are under the general charge of Dr. Elwood Mead, commissioner, with headquarters in Washington. In addition to those furnishing data, as mentioned in Tables I and II of this article, the writer is indebted to Joel D. Justin, C. H. Paul and O. N. Floyd for their valuable suggestions.



Dam Under Construction Across Waitaki River

Public Works in New Zealand

Railroad Construction, Bridges and Tunnels, Highway Problems and Hydro-Electric Developments Occupy Attention of the Government

By Harold E. Babbitt
Professor of Sanitary Engineering, University of Illinois

THERE is a striking similarity in climate, labor conditions and methods of engineering procedure between New Zealand and certain sections of the United States. British and American construction equipment and methods are in general use, and American engineering literature and periodicals have wide circulation among New Zealand engineers. The New Zealander is not backward in choosing the equipment best suited for the work in hand regardless of its place of manufacture. The most outstanding difference between New Zealand and American methods is the tendency there to turn all works of importance over to the public works department of the dominion government, leaving only a narrow field for the engineer in private practice.

The public works department of the dominion government is organized to care for the design and construction of the principal engineering works in the commonwealth with the exception of certain municipal work. The scope of the activities of this department is indicated by the data in Table I, which show the expenditures during the year ended March 31, 1929. It will be seen from a study of this table that the principal activities of the department are in relation to railroads, water power and highways.

Railroad and Bridge Construction

Construction of 191 miles of railroads was in progress on April 1, 1929, and during the preceding year 106 miles of railroad were completed. A total of 3,302 miles of railroads is in operation and 1,071 miles were either projected or under construction. All lines have a gage of 3 ft. 6 in., mostly single track with 75-lb. rail on the main lines. The longest section on which construction is in progress is 130 miles, between Napier and Gisborne on the North Island. It traverses rough country, necessitating the construction of bridges, tunnels, long cuts and heavy fills.

Among the longest bridges are the Wairoa River bridge, the Mohaka viaduct, the Waikare viaduct and the Matahoura viaduct. All are of steel, the first named being through-truss spans and the others all deck-truss spans. The Wairoa River bridge is 350 ft. 4 in. long, divided into five spans, the longest of which is 107 ft. 6 in. long. The rail level is so close to high-water level as to necessitate through-truss construction. The Mohaka and Waikare viaducts are more imposing structures because of their height above the streams. The former is 450 ft. long with five spans, the longest of which is 250 ft. It stands 208 ft. above the streambed. The latter is 610 ft. long with nine spans, the longest of which is 100 ft. It stands 205 ft. above the streambed. The Mohaka viaduct, which will be the longest and highest on the line, is not yet under construction. The higher bridges are equipped with wind-break fences to prevent trains from being blown off. The viaduct spans are supported on steel towers resting on concrete foundations which have been sunk, as caissons, to bedrock.

Railroad Tunnels

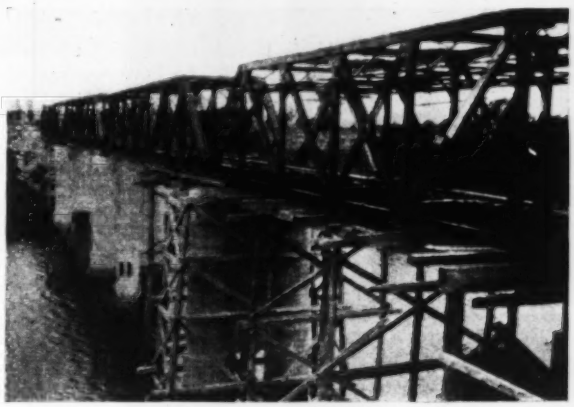
The principal tunnels on the line include the Kotemaori, Chimney Creek No. 1 and No. 2, Mohaka and Waihua,

TABLE I—EXPENDITURES BY THE PUBLIC WORKS DEPARTMENT OF NEW ZEALAND FOR THE YEAR ENDED MARCH 31, 1929

Class of Work	Expenditure in Pounds Sterling
Railways:	
New construction	1,902,872
Additions to open lines	213,405
Improvements	2,007,617
Roads	833,577
Main highways	1,916,408
Public buildings	213,505
Immigration	50,266
Lighthouses, harbor work and defenses	17,063
Tourist and health resorts	39,254
Telegraph extension	624,414
Defense works (general)	67,652
Departmental	142,253
Irrigation and water supply	55,197
Lands improvement	85,861
Water-power works	1,183,103
River improvements	52,310

with a total length of about 1½ miles. In most of the tunnels the driving is rather wet, but the material is a soft sandstone in good condition for cutting. The material is sufficiently hard to require blasting, but it disintegrates rapidly on exposure to the weather, necessitating lining the tunnel with concrete. Excellent and economical concrete work is being secured by control of the proportions, the mixes being designed for a desired water-cement ratio. Ingenious automatic devices are in use on the mixer to maintain the desired proportions.

Railroad construction on most lines is close to or alongside of existing highways. This facilitates construction and has encouraged the policy of constructing the railroads in numerous detached sections because of the transportation facilities along the line furnished by the highway. Where no convenient highway exists the board, which controls both highway and railroad construction, builds a highway to facilitate the railroad work. Heavy bridge steel is usually transported over the newly completed railroad, necessitating the completion of steel bridges in consecutive order from each end of a section communicating with boat or rail transportation in operation. The main highways, under the control of the main highways board, total slightly more than 10,000 miles in length. This board has been operating only for the past five years. During this period the expenditures on maintenance and construction on the main highways have totaled about $34,000,000, of which $11,000,000 was expended in 1928-29. About one-quarter of the expense of construction and maintenance is borne by local authorities. The condition of parts of the highways is unsatisfactory because of dust, the use of loose gravel surface in which automobiles skid easily and the use of one-way bridges. On some of the minor highways single-track bridges are used to carry both highway and railroad traffic.



WAIROA RIVER BRIDGE

One of the principal functions of the main highways board is to provide such types of roads as will withstand the destructive effects of motor vehicles, provide a reasonably smooth running surface, and, where circumstances warrant, eliminate the dust nuisance. The dust-free types of surface in use range from a tar-sealed macadam surface to a portland cement concrete pavement. The total length of such improved highways in rural sections is now 830 miles. It is felt by the main highways board that the advances made in road construction are proportionate to the use of roads by motor vehicles.

An interesting comparison of highway expenditures in eleven American states, two Australian states and New Zealand has been made by the main highways board. The figures are shown in Table II. The population of the American states selected for comparison range from 800,000 to 2,500,000, which is about the range of New Zealand and the Australian states. The length of surfaced roads in New Zealand is 63 per cent of the total length of the roads, whereas in the United States only about 20 per cent of the total road lengths is surfaced. Most of the surfaced roads of New Zealand are of gravel, which makes an all-weather road but a dusty and dangerous highway for motor traffic, whereas a relatively high percentage of American surfaced roads have a better type of surface.

The principal method of combating dust in New Zealand is by a tar and bituminous surface treatment. Of 198 miles of dustless roads constructed in 1928-29, 122 miles had a tar and bituminous surface; 51 miles were of bituminous macadam (penetration); 14 miles were of bituminous concrete, and 11 miles were of portland cement concrete.

The policy of the main highway board is to let most of the work by contract. Bids for 18-ft. concrete roads, 9x6x9-in. section with 3-ft. bituminous shoulders in some cases, have ranged from $29,000 to $34,000 per mile. Single-course bituminous pavements have been let for $15,000 per mile for an 18-ft. width, 2½ in. thick, where aggregate is reasonably cheap.

TABLE II—HIGHWAY EXPENDITURES IN 11 AMERICAN STATES, TWO AUSTRALIAN STATES AND NEW ZEALAND*

	Total Expenditure by Main Authority	Expense per Motor Vehicle	Expense per Head of Population
Alabama	11,250,000	46.10	4.35
Arkansas	7,100,000	34.29	3.64
Colorado	6,200,000	23.10	5.70
Kansas	21,650,000	43.10	11.93
Louisiana	11,800,000	46.25	6.06
Maine	11,550,000	70.39	14.50
Maryland	7,700,000	28.39	4.75
Mississippi	4,750,000	21.75	2.64
Nebraska	7,250,000	19.37	5.14
Oregon	6,950,000	28.35	6.95
South Carolina	13,250,000	66.25	7.10
Victoria	11,327,500	75.50	6.39
New South Wales	16,875,000	80.00	6.89
New Zealand	9,585,000	48.00	6.52

*Expressed in dollars based on the assumption that £1 equals $5, 1 shilling equals 25c. and 1 penny equals 2 cents. Data for American states are for 1927; for Australian states are for 1928, and for New Zealand are for 1929.

Hydro-Electric Development

The development of hydro-electric power is an important activity of the construction work by the public works department, as indicated by the figures in Table I. On March 31, 1929, 30 hydro-electric stations were in operation, with a total capacity at maximum load of 113,360 kw. The principal projects under construction are at Arapuni, Waikaremoana and the Waitaki River. The greater portion of the construction work at Arapuni and Waikaremoana is complete and power is being delivered from these stations. Work was commenced on the Waitaki River project in June, 1927, and it is probable that power will be available from it in two or three years. The maximum load capacity at Arapuni is 30,000 kw.; at Waikaremoana it is 35,000 kw., with extensions now under way.

Construction work at the Waitaki River plant involves a bold plan for damming the river, which has a minimum flow of about 5,000 sec.-ft. and an assumed maximum flow of 160,000 sec.-ft. The Waitaki River rises 100 miles from the dam site in the glaciers of Mount Cook and the southern Alps. Because of its glacier-fed character high water occurs in the river during warm weather when working conditions are otherwise good and low water in winter when sub-zero temperatures must be

contended with. Little is known of the characteristics of the stream, as records of flow are available for only two years. It is expected, however, that the existence of a number of lakes on the watershed above the dam will diminish the flood peaks to be carried over the works. A characteristic of the river at the dam site is an increase in velocity of flow rather than in depth of water, with increased rate of discharge. With a discharge of 160,000 sec.-ft. it is assumed that the surface velocity may reach 20 ft. per second. The dam to be constructed will be of concrete. Its general dimensions will be: length at top, 1,800 ft.; maximum height, 100 ft.; volume of concrete, 140,000 cu.yd. The bed of the river at the dam site consists of loose gravel (shingle) underlain at various

CONTROL WORK ON THE WAIMAKARIRI RIVER
Note cypress and willow plantings and protection of end of wing dam.

depths up to about 30 ft. by solid bedrock of irregular profile, which provides an excellent foundation.

The procedure in the construction of the dam has been to construct two trestles across the river about 400 ft. apart on each side of the dam site. These trestles will be used for the transportation of materials and to serve as supports from which steel sheetpiling for the cofferdam can be driven. The piles, crossbraces and other parts of these trestles consist of old street car rails, which have been found more suitable than wooden piles, as they are more easily driven in alignment, will penetrate the gravel and loose boulders better than wood piles, and have even penetrated the bedrock to depths of 2 or 3 ft. Where used as cofferdam braces the rails can be concreted in the finished dam, thus making the cofferdam bracing more secure during construction.

Upon completion of the upstream trestle a rectangular cofferdam about 40 ft. wide across the stream and 400 ft. long down the center line of the stream was placed with steel sheetpiling. When the cofferdam was dewatered there was a maximum height of water above the foundation rock of 20 ft. A section of the concrete dam was constructed to be used as a support and guide for the remainder of the work.

The next step will be to extend the steel cofferdam from the center pier to the left bank of the river, to dewater the dam and excavate this part of the foundation, and to construct the left half of the dam to a height sufficient to give a firm foundation for subsequent construction and to withstand flooding. During this period of construction the flow of the river will be confined to the right half of the channel. Upon completion of the lower portion of the left half of the dam the river will be allowed to flow over it while the right half of the dam is constructed in a similar cofferdam. This procedure will be followed until the dam is complete, the flow of the river being cared for over alternate halves of the work and through the control gates as they are completed. The plan is bold because of the heavy scouring velocities of the stream and the possibilities of floods during construction. Upon completion the plant will deliver 115,000 kw. under an effective head of 70 ft. It is estimated that the installation will cost $7,500,000.

The lower portions of many of the principal rivers of New Zealand meander through broad, flat, gravel-filled valleys in channels which change frequently with the character and intensity of each flood. River control is therefore desirable to preserve valuable lands. The most extensive river-control work is being done on the Waimakariri River near Christchurch by the Waimakariri River Trust, a local authority not under the dominion public works department. A maximum flow of 150,000 sec.-ft. is to be cared for by the excavation of a new and straightened channel protected by levees to allow a freeboard of 2 ft. Erosion of new channels will be prevented by the construction of wing dams, pointing upstream, connected to the levees and protected at the

RAILROAD CONSTRUCTION IN NEW ZEALAND
Showing type of country crossed, and cuts and fills under construction, Napier-Gisborne line.

exposed ends by concrete blocks. The main levees and portions of the flood channel will be protected by willow and poplar trees which grow luxuriantly in gravelly soil on river banks. The work includes the construction of 1½ miles of concrete highway, 6 miles of gravel highway and a concrete bridge 20 ft. wide and 1,160 ft. long. The work has been under way since January, 1929, and it is assumed that it will be completed in eight to ten years. The estimate of the cost of the work is roughly given as about $900,000.

Auckland, Wellington and Christchurch are the three largest cities in New Zealand. The largest public work under construction in these three cities is the vehicular tunnel under Mount Victoria in Wellington. The tunnel will be 30 ft. in diameter and ½ mile long, and will cost about $1,000,000. A comprehensive extension will probably be made to the water supply of Wellington in the near future, and borings are being made in Auckland harbor to aid in locating the site for a proposed bridge.

Much of the information herein was secured through the aid of F. W. Furkert, engineer-in-chief of the public works department; F. T. M. Kissel, chief electrical engineer of the public works department, and W. H. Gregory, district engineer at Waikaremoana. Other information was obtained by visits to district, city and resident engineers, to whom a debt of gratitude is due for their exceptional cordiality and helpfulness.

Machine Mixing on Highway Marks Innovation in Road Oiling

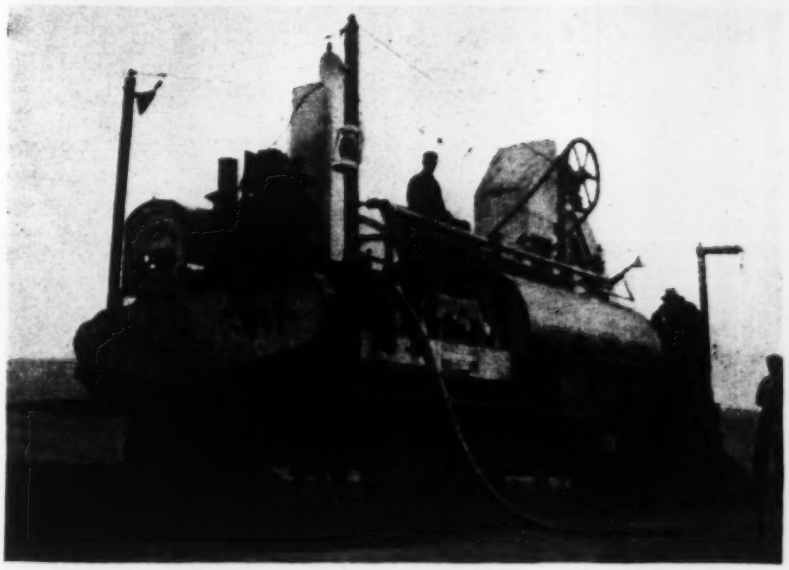
Stack of Surfacing Is Picked Up, Weighed and Mixed With Oil—Device Has Advantages of Plant and Road-Mix Methods

TO COMBINE the advantages of both the plant- and road-mix methods of producing an oiled surfacing for highways, a machine has recently been devised which batches and mixes the surfacing material on the road, with the elimination of much of the blade-mixing operation. The self-propelling machine picks up the stacked road metal, weighs it, adds a specified amount of oil, and mixes and deposits it in a stack ready for spreading. It was used for the first time on a 60-mile oiling contract between Butte and Dillon for the Montana state highway department. The new construction principles involved in this method have aroused considerable interest on the part of contractors and highway officials in the Northwest, where the road mix method of highway construction is used extensively.

The machine, as now used, has essential parts consisting of a bucket elevator at the forward end discharging into a two-compartment weighing hopper, oil tanks with batching control, and a mixing compartment 15 ft. long equipped with paddles, from which the material drops in a continuous stack on the road. With each discharge of the weighing hopper a quantity of heated asphaltic oil is discharged through several openings into the batch at the upper end of the mixing compartment. The oil is carried in two 400-gal. tanks on the machine; a heater is used to maintain the correct temperature. The supply is replenished from an ordinary distributor truck without interrupting the mixing process.

All the operations, including the forward motion, are powered by a 65-hp. gasoline engine; a small generating plant is mounted on the machine to furnish electric light for night operation. The mixer capacity is designed for 50 to 60 cu.yd. of stone per hour, and the machine moves forward at a rate of 2 to 7 ft. per minute, depending on the volume of material in the stack. This volume, in turn, is dependent upon the depth of surfacing required and the width of roadway.

On the initial job, Butte to Dillon, with an 18-ft. width of roadway and a 3-in. thickness of oiled surfacing required, the machine was able to mix a maximum of 1 mile of surfacing in a 20-hour continuous run. The amount of oil used was about 1½ gal. per square yard of road surface. The reciprocating weighing hoppers were set to measure a 109-lb. batch of material which contained a fairly heavy proportion of fines, and a charge of 0.65 gal. of 60-70 per cent road oil was added. The resulting mixed surfacing had 4.6 per cent oil content.



TRAVELING MIXER FOR ROAD OILING

An elevator at the front (upper view) picks up 50 to 60 cu.yd. per hour. The mixed material is deposited in a windrow behind the machine (lower view). The oil supply can be replenished through the hose (in lower view) without stopping operation. Only a small crew is required.

Ahead of the machine the metal had been bladed into a stack about 5 ft. from the edge of the roadway; the mixed stack was dropped in about the same position. Before spreading, the clear half of the roadway was given a light tack coat of oil and then the mix was bladed over onto the tacked surface. The other half of the base then was tack coated and the mixture spread out for traffic rolling.

The machine was developed primarily to combine the flexibility of the road-mix method, as regards the utilization of material already in the surfacing, with the advantages of batching and proper oil control, which are a feature of the plant-mix method for new surfacing. The testing of the road metal at frequent intervals ahead of the machine to determine the proper oil proportioning is essential to the most advantageous use of this new method. With this advance information available it would be possible to produce a mix with an oil control more uniform than with the blading method and even to approximate the control obtainable in plant mixing. In addition to the possibility of more complete control, it is estimated that the mixing done by the machine eliminates about twelve bladings necessary to produce the same results with the usual road-mix methods.

The general principles of the machine were developed by F. M. Hargrave, of the Hargrave Construction Co., Cedar Rapids, Iowa, and Spokane, Wash. The mechanical details were the joint work of Mr. Hargrave and the Iowa Manufacturing Co., Cedar Rapids builders of the machine. The Montana contract was under the supervision of R. P. Newland, state maintenance engineer, under the general supervision of R. D. Rader, state highway engineer. L. S. Barber was superintendent for the contractor.

Spiral Dropshafts 100 Ft. Deep on St. Paul Sewers

Four Shafts on Kittsondale Project Designed With Helical Waterways to Avoid Effects of Free Fall

By C. M. Colestock

Senior Assistant Engineer, Department of Public Works, St. Paul, Minn.

SPIRAL DROPSHAFTS 100 ft. deep with staircase waterways have been developed by the city of St. Paul for junction between the lateral sewers and outfall tunnels on the Kittsondale relief sewer system. On this project, as on many other St. Paul sewers, the outfalls are tunnels driven at Mississippi River level, averaging 100 ft. below the level of the laterals. Four shafts are required on the Kittsondale system, which is being built to serve a drainage area of 2,850 acres. Two of these shafts, 16 ft. in diameter, are capable of passing 1,400 to 1,900 sec.-ft. The other two are much smaller, being 8 ft. in diameter. Two outfall sewers for this area are to be constructed as tunnels in solid limestone rock, 100 ft. deeper than the laterals.

In the plain dropshafts constructed heretofore as part of the St. Paul sewer system, considerable trouble has been experienced from the air pressures built up in the sewers by the long free fall of the water. In addition, the difficulty of making regular examinations of the deep shafts led to their frequent neglect, so that occasionally serious emergencies have developed that could have been avoided at small expense by timely repairs. The new dropshafts are designed to eliminate these sources of trouble by providing a waterway similar to a spiral stairway. Such a design avoids the free fall of the sewage from the laterals to the outfall and also allows easy access for the purposes of inspection.

The larger shafts are 16-ft. inside and 22-ft. outside diameter. In the center there is a dry shaft 3½ ft. in diameter with walls 15 in. thick. In the 5-ft. space between the outer wall and the central shaft, the spiral waterway of 14-ft. pitch is constructed. The floor of this waterway is stepped, and the risers are 7 in. high. The central shaft provides a dry means of access to the tunnel and can also be used to carry the dry-weather flow if repairs to the stairway should become necessary. Details of this type shaft are shown in Fig. 1. In the construction of the shaft, the 3-ft. outer shell was built first, leaving keyways in the inner wall to support the

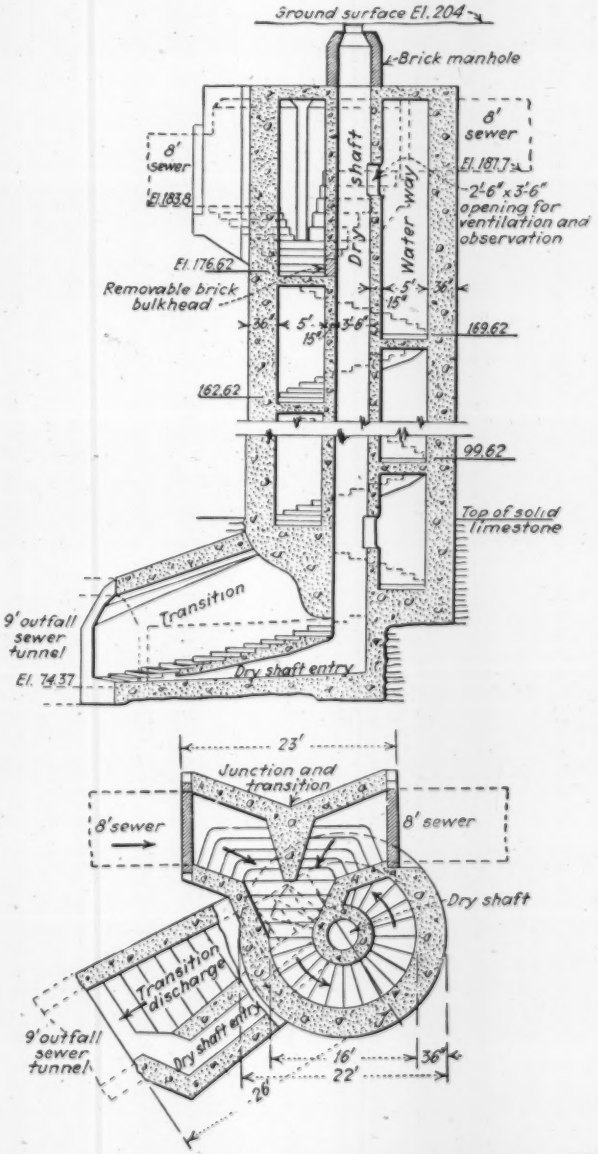


FIG. 1—DETAILS OF LARGE SPIRAL DROPSHAFTS
Stairs are cast integrally with center dry shaft.

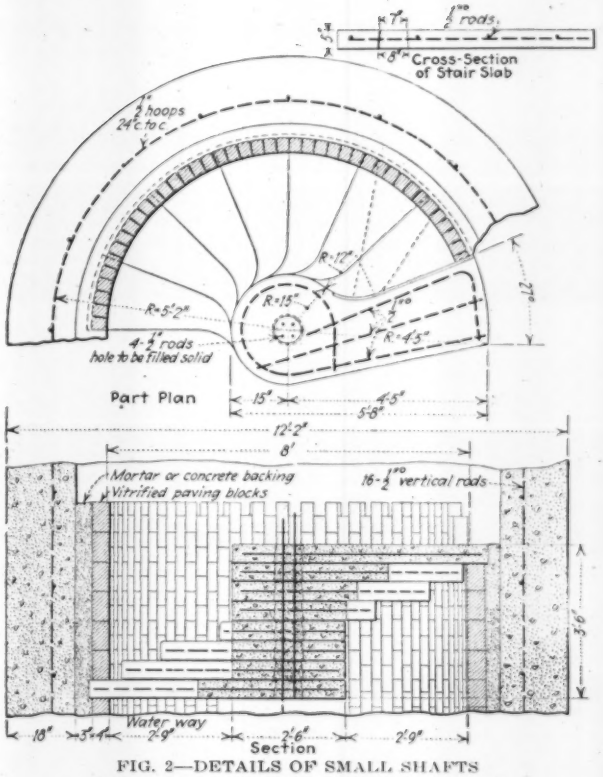


FIG. 2—DETAILS OF SMALL SHAFTS
Stairs are precast and are placed along with paving-brick lining.

stairs. The central shaft and the stairway were built together.

The smaller shafts, 8 ft. in diameter, are lined with paving brick. The spiral stairway is built of precast reinforced-concrete slabs, so shaped at one end as to form the central column (Fig. 2). The width of the slab is sufficient to permit a variation in the pitch of the spiral by increasing or decreasing the number of steps in each turn. As the small shafts are not designed to take the dry-weather flow, an open central shaft is not needed.

For about half the depth the excavation for the shafts was in glacial drift containing a heavy flow of water. The shafts were successively sunk through this material by the use of pressed-steel liner plates to form a cofferdam wall, the plates being held by angle-iron rings without the use of any crossbracing. The remainder of the excavation was through shale and solid rock.

The work is being done under the direction of William H. Carey, chief engineer of the department of public works. A. Guthrie & Co. and the Northern States Contracting Co., both of St. Paul, are the contractors for the major part of the work. The cost of the entire improvement is estimated at $1,765,000.

Road Construction in Mexico

A statement issued by the Mexican government shows that during the first eight months of this year 50,641,962.91 pesos, equivalent to $25,320,981.46 was spent on highway construction and for surfacing approximately 840 miles of completed road. The budget of the national highway commission for 1930, 1931, 1932 and 1933 provides for a total expenditure on highway construction of 80,000,000 pesos.

Properties of Sections Experimentally Illustrated

By F. T. Llewellyn
U. S. Steel Corp., New York, N. Y.

IT IS possible to determine the properties of any homogeneous section by means of a hacksaw, a grinder, a pair of scales and a knife-edge. The method presented here is rational and universal in application. Admittedly, the use of a mechanical integrator will permit the determination of the desired properties with the expenditure of less time and effort. Of greater value to the engineer than speed, however, is the visual manner in which the method illustrates the physical significance of abstract relations whose meaning is often taken for granted. For example, to define radius of gyration, as applied to objects that do not rotate, is no easy matter without bringing in concepts of fictitious forces; but to express it as a tangible dimension—the geometric mean of two readily measured distances—is to indicate its significance

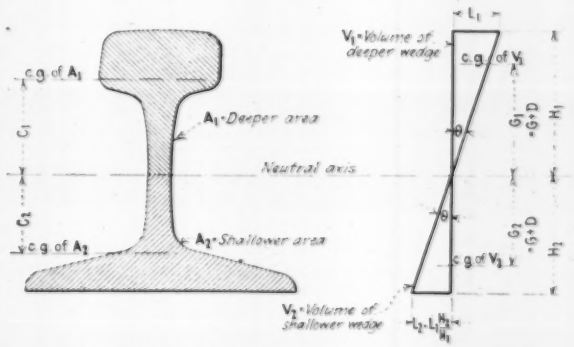


FIG. 1—RAIL SECTION USED IN DETERMINING PROPERTIES

in terms that are understood at once, as will be shown later.

Again, the useful strength of a beam is measured by its section modulus, a three-dimensional quantity that may be derived mathematically from its moment of inertia—an imaginary four-dimensional trespasser. More logically, the method here presented bases the derivation of section modulus on a familiar quantity in our three-dimensional world—namely on a solid or volume.

In order to ascertain the properties of any member, such as a rail (Fig. 1), with reference to its neutral axis, cut a normal transverse slice of uniform thickness L_1, which for convenience may be made approximately one-tenth of its depth. Weighing the slice and dividing by the product of L_1 and the unit weight of the material determines the cross-sectional area $(A_1 + A_2)$.

Balance the slice on a knife-edge parallel to the desired axis, thus marking the neutral axis, and cut the slice into two portions through this axis. Balance the deeper of the severed portions in a similar manner, thus determining C_1, the distance to the center of gravity of the area. Then grind this portion into the form of a wedge tapering from zero at the axis to a thickness or length L_1 at the point farthest away from the axis. Weighing this wedge and dividing by the unit weight of the material determines its volume V_1. Next, balance the normal face of the wedge parallel to the neutral axis, thus

marking G_1, the distance to the center of gravity of the volume.

In the same manner determine V_2 and G_2 for the shallower portion, taking care that the slope of the shallower wedge shall be the same as that of the deeper one, thus making L_2 proportionately less than L_1. It only remains to establish the relations desired.

The moment of resistance R of the entire section equals the sum of the products of the wedge volumes and the respective distances of their centers of gravity, i.e.:

$$R = V_1G_1 + V_2G_2$$

$$\text{The section modulus } S = \frac{R}{L_1} = \frac{V_1G_1 + V_2G_2}{L_1}$$

The square of the radius of gyration r equals S multiplied by the depth of the deeper wedge and divided by the area of the entire section, i.e.:

$$r^2 = \frac{SH_1}{A_1 + A_2} = \frac{H_1}{L_1} \times \frac{V_1G_1 + V_2G_2}{A_1 + A_2}$$

For symmetrical sections this reduces to the product of the distances to the center of gravity of the area and of the volume, i.e., $r^2 = C_1G_1$. Additional expressions of the properties are given in the accompanying table.

If desired, an enlarged model made of any homogeneous material may be used. If its ratio of linear enlargement is B, then the S of the actual section is obtained by dividing by B^3, and the square of the radius of gyration r^2 is obtained by dividing by B^2.

The validity of the method here presented is based upon the following proof: Any cross-section may be divided into elemental three-sided areas, each of which is bounded by a vertical co-ordinate axis, a line normal to it, and any curve that intersects the origin of axis. The shaded figure in Fig. 2 represents such an area.

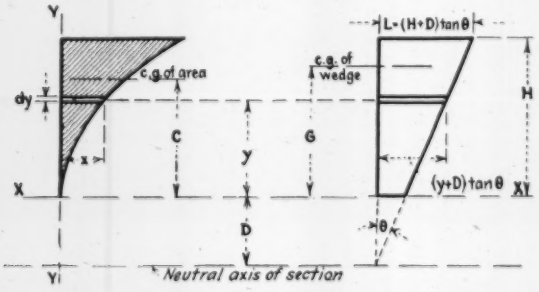


FIG. 2—AN ELEMENTAL THREE-SIDED AREA
Any cross-section can be divided into similar areas, bounded by a vertical axis, a line normal to it and any curve that intersects the origin of the axis.

Let xdy = elemental slice of shaded figure bounded by X-X, Y-Y and any curve $x = \phi(y)$

Let A = area of figure $= \int_o^H \phi(y)dy$

and I_{na} = 2nd moment of any slice $= \phi(y)dy(y + D)^2$

Therefore,

$$I_{na} \text{ of figure} = \int_o^H \phi(y)dy(y + D)^2$$

The volume of any slice $= \phi(y)dy(y + D)\tan\theta$

Therefore, volume of

$$\text{wedge} = V = \int_o^H \phi(y)dy(y + D)\tan\theta$$

EXPRESSIONS FOR PROPERTIES OF SECTIONS

Properties With Respect to na	Value in Terms of Quantities Experimentally Determined	
	Any Section Where $H_1 > H_2$	Section Symmetrical About na. $[H_1 = H_2]$
I	$\frac{V_1G_1H_1}{L_1} + \frac{V_2G_2H_2}{L_2} = (V_1G_1 + V_2G_2)\cot\theta$	$2A_1G_1C_1 = 2V_1G_1\cot\theta$
S	$\frac{V_1G_1 + V_2G_2}{L_1} = \frac{A_1G_1C_1 + A_2G_2C_2}{H_1}$	$\frac{2V_1G_1}{L_1}$
r^2	$\frac{S_1H_1}{A_1 + A_2} = \frac{A_1G_1C_1 + A_2G_2C_2}{A_1 + A_2}$	G_1C_1

$V(G + D)$ = 1st moment of wedge about na, which is also equal to

$$\int_o^H \phi(y)dy(y + D)\tan\theta\,(y + D)$$

Therefore,

$$\frac{I_{na}}{V(G+D)} = \frac{\int_o^H \phi(y)dy(y+D)^2}{\int_o^H \phi(y)dy(y+D)^2\tan\theta} = \frac{1}{\tan\theta} = \cot\theta$$

Therefore,

$$I_{na} = V(G + D)\cot\theta = \frac{V(G+D)H}{L}$$

It can be shown, by summation, that for any section, such as the rail in Fig. 1, the I of the deeper portion $= \frac{V_1G_1H_1}{L_1}$. Similarly, I of shallower portion $= \frac{V_2G_2H_2}{L_2} = \frac{V_2G_2H_1}{L_1}$ and I of the total section $= \frac{(V_1G_1 + V_2G_2)H_1}{L_1}$

But $S = \frac{I}{H_1}$, so that $S = \frac{V_1G_1 + V_2G_2}{L_1}$

World's Largest Graving Dock for Southampton

The world's largest graving dock is to be constructed at Southampton, England, to meet the request of the Cunard Steamship Co. that accommodation be provided at that port for dry-docking the large vessel it is about to construct. The dock is to be built by the Southern Railway, and will be 1,200 ft. long and 135 ft. wide at the entrance, with a depth of 45 ft. The government has undertaken to assist under the development (loan guarantees and grants) act of 1929. The new dock will ultimately replace the existing floating dock now installed at Southampton. This work, and the second stage of the Southampton docks extension scheme, which the Southern Railway directors have also decided to put in hand immediately and which the government has also undertaken to assist, will take several years to complete.

The new dry dock will be the seventh at Southampton, excluding the floating dock. It is hoped that it will be ready by 1933, exactly 90 years after the opening of the first wet dock at the port to marine traffic.

The world's largest graving dock at present is at Boston, where the U. S. Navy Department owns the Commonwealth Dry Dock. This is 1,200 ft. long, the same length as that of the proposed Southampton structure, but its breadth at the entrance is only 120 ft.

The largest graving dock in Britain at present is the Gladstone dock at Liverpool, which has a length of 1,050.4 ft., a width of 120 ft. and a depth of water over the sill of 43.4 ft. at ordinary spring tides.

Overheating of Aggregates Found Detrimental to Concrete

By William H. Bachelder
Formerly Assistant Engineer of Tests, Minnesota Department of Highways, St. Paul, Minn.

During cold weather it is often necessary to heat concrete aggregates in order to make them suitable for use. Some specifications require that the aggregates be heated so that the concrete when placed will be between 70 and 140 deg. F. This range of temperature undoubtedly has some effect on the chemical reaction that takes place when the cement sets. It has been generally assumed that the effect of the higher temperatures on the resulting concrete would be beneficial or at the worst negligible. A series of tests carried out in the Minnesota highway department laboratory and herein described shows definitely what this effect is and that to get the full development of the inherent strength of the concrete the temperature of the concrete when placed should not exceed 70 deg. F.

For these tests the aggregates and water were heated sufficiently to give the batch a temperature of 70, 100, and 130 deg. F. when discharged from the mixer. Due to the fact that the specific heat of water is much higher than that of any of the other ingredients the temperature of the mixing water was most important. All materials except cement were heated.

It was found that to get the same workability it was necessary to add more water to the warmer mixes. Measuring the workability by the flow, 5.7 gal. of water per sack of cement was used for 70 deg. F. concrete, 6.07 gal. for 100 deg. F. concrete, and 6.85 gal. for 130 deg. F. concrete. This gave a constant consistency about equivalent to a 4½-in. slump, using a 1 : 2.07 : 3.12 mix by weight of cement, sand, and gravel. Flow tests were run on a 30-in. table using thirty ⅛-in. drops in 30 seconds. The results of the strength tests are plotted in graph No. 1.

Transverse tests were made on 6x6x30-in. beams. Three beams were tested for each point on the graph. Each beam was broken twice on a 15-in. span with center load. Four 6x12-in. cylinders were tested for each point on the compression curve. All specimens were cast in a room at approximately 70 deg. F. and covered with wet burlap and oilcloth for twenty hours. They were then moved to a moist curing room maintained at 70 deg. F., where they remained until tested. No attempt was made to prevent loss of heat after the concrete was placed. The results are plotted in Fig. 1.

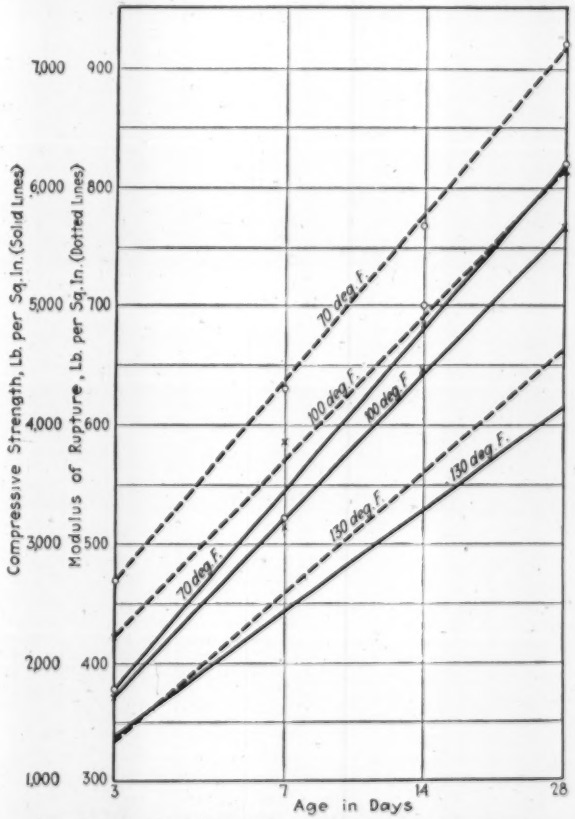


FIG. 1—RESULTS OF STRENGTH TESTS OF HOT MIXED CONCRETE

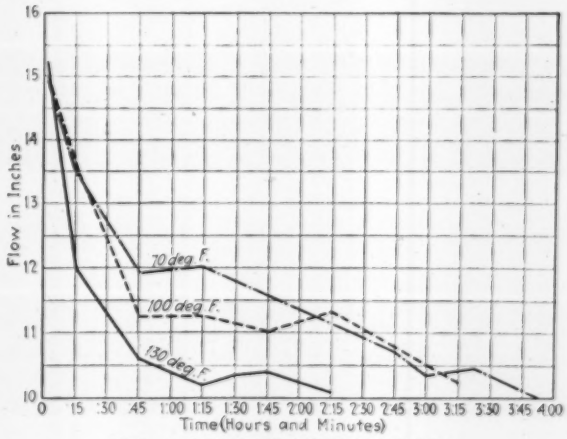


FIG. 2—RESULTS OF FLOW TESTS

In addition to strength tests, time to set was determined by making several flow specimens and testing them at different intervals until the concrete ceased to flow. Results of these tests are shown in Fig. 2. They show, as is to be expected, that the warmer the concrete when placed the faster it sets up. These tests were all run on concrete of approximately the same consistency, because that is the nearest approach to field conditions possible in the laboratory. To get this same consistency it was necessary to use more water in the warmer mixes. However, examination of the data and comparison with the difference in strength to be expected from the difference in the water-cement ratio show clearly that less than half the difference in strength is due to the additional water. Tests for water content indicate that about one-sixth of the additional water used in the 100 deg. F. concrete and about one-fourth of the additional water used in the 130 deg. F. concrete was lost before the concrete was tamped. In order to bring out this point further, 28-day tests were made at the different temperatures, using a constant water-cement ratio. The results of these tests were:

Temperature, Deg. F.	Transverse, Lb. Per Square Inch
70	881
100	817
130	794

It is believed that the results of these tests indicate that concrete should not be placed too hot, that concrete placed at 130 deg. F. loses approximately 20 per cent of its strength, and that the expense of insuring the proper temperature is justified.

Corpus Christi Dam Failure

Rolled-Fill Earth Dam on Sand and Gravel, With 1,250-Ft. Concrete Spillway on Piles, Was Breached by Water With the Loss of One Spillway Abutment and 200 Ft. of the Adjacent Rolled-Fill Embankment

FAILURE of the La Fruta dam for the water supply of Corpus Christi, Tex., on Nov. 23, as noted in the news section of *Engineering News-Record*, Nov. 27, p. 861 and Dec. 4, p. 897, was caused by water passing the sheetpile cutoff at the north abutment of the spillway. The abutment pulled away from the weir section of the spillway and fell toward the earthfill which it supported and which was breached by the released waters for a length of about 200 ft. toward the north bank. Besides the destruction of the abutment and its foundation and training wall, about 60,000 cu.yd. of the dam embankment was carried away. The 50-ft. section of spillway weir adjacent to the abutment was moved out of line and level a fraction of an inch. Otherwise it is intact, except where the toe of the base of the abutment tore out from underneath leaving an overhang of about 10 ft. The course of the flood down the wide uninhabited valley of the river did no damage beyond drowning a few cattle and washing sand into some farm land. It is estimated that $3,000 will cover the flood damage.

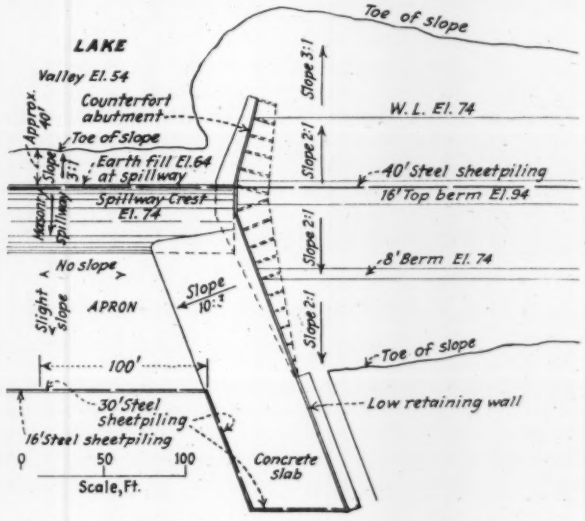


FIG. 2—ORIGINAL STRUCTURE OF DAM AT ZONE OF FAILURE

Dam Structure and Construction

The La Fruta dam crosses the valley of the Nueces River about 35 miles west and north of Corpus Christi. Its structure and construction were described in *Engineering News-Record*, Oct. 2, 1930, p. 520, where details of the earthfill and concrete spillway sections were given. Fig. 1 is a sketch plan of the dam with approximate contours of the valley and showing the course of the river after the failure. The narrow pilot channel indicated is being excavated to cut off the loop in the river by making a path for the water to erode a new channel. The drawing indicates the general structure and the main dimensions of the dam. Succeeding illustrations will refer only to the damaged portions.

A sketch plan of the north abutment zone of the dam as constructed is shown by Fig. 2. Fig. 3 is the abutment as designed, in which the vertical section shows the method of supporting the base under the weir. The abutment footing was founded on wood piles spaced 3 ft. on centers and driven to practical refusal. The depth of piling was 25 to 30 ft.

A row of 35-lb. steel sheetpiles 40 ft. long was driven across the valley on a line coming about 1 ft. inside the vertical upstream face of the weir section and about under the mid-crest axis of the embankment section. The tops of these piles were embedded about 2 ft. in the weir section

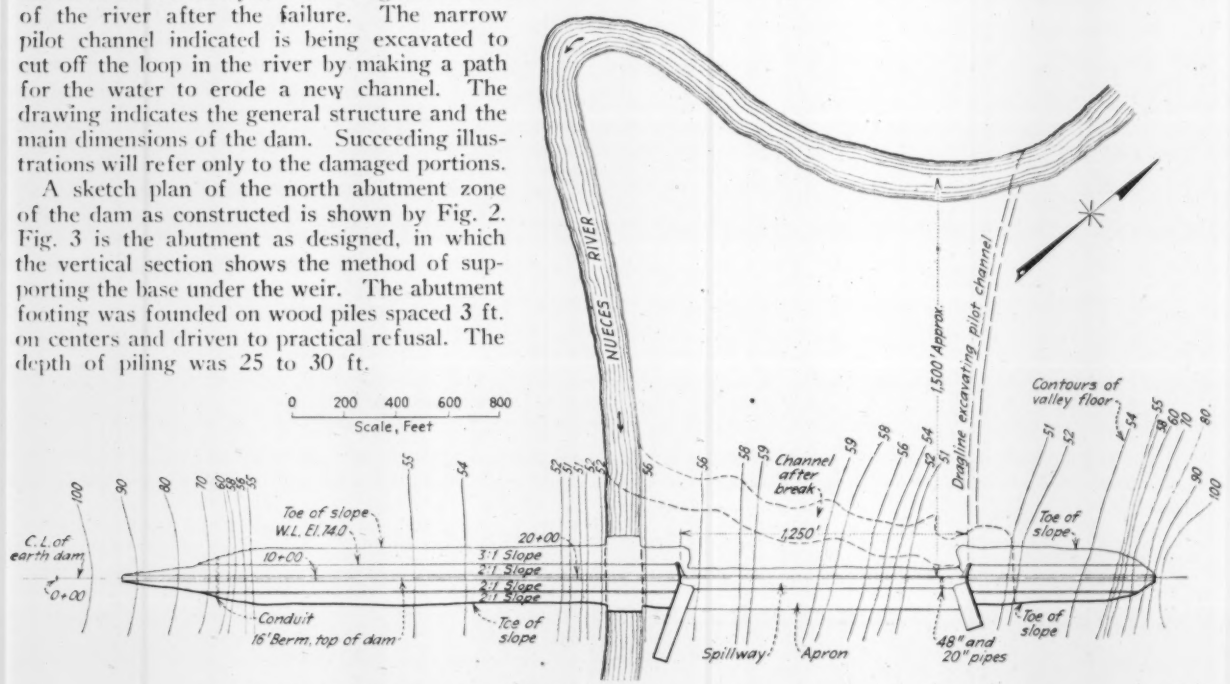


FIG. 1—PLAN OF THE DAM FOR THE WATER SUPPLY OF CORPUS CHRISTI, TEX.

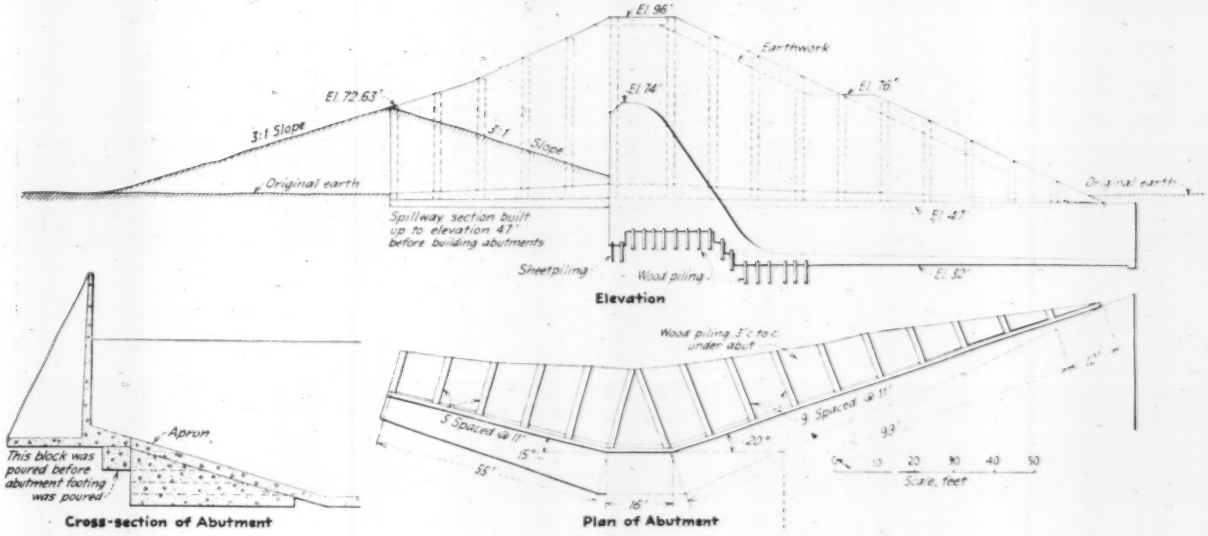


FIG. 3—ABUTMENT DESIGN FOR LA FRUTA DAM

and abutment concrete. Another row of steel sheetpiling (21 lb. and 16 ft. long) was driven along the inverted toe wall of the spillway apron with the pile tops embedded in the toe-wall concrete. At the abutment, as shown by Fig. 2, the normal downstream or apron sheeting was replaced by a row of 30-ft. sheetpiling for 100 ft. along the toe of the apron and along the exposed front and end of the training wall.

Supporting Piles and Sheetpiles

The specifications called for wood piles having 12- to 14-in. butts, and 5- to 8-in. points, driven to refusal indicated by the formula $S = (WH \div 30{,}000) - 0.1$ for steam hammers. The steel sheetpiles were required to conform to A.S.T.M. specifications; the 35-lb. having a web thickness of $\frac{3}{8}$ in. and 21 lb., a web thicknes of $\frac{1}{3}$ in. All pile heads were embedded in the spillway and abutment concrete. Under embankment the steel sheeting was driven in a 10x12-ft. core trench and projected upward about 3 ft. into the backfill. The engineering inspection, it is stated, was exacting as to piles and pile-driving and placing.

Across-Valley Section and Profile

The valley of the Nueces is alluvial. At the site of the dam, which is at a narrow point in the valley, it is over 4,000 ft. wide—the crest length of the dam is 4,080 ft. An across-valley section is shown by Fig. 4. As indicated by the borings, the material below the top layer of 5 to 10 ft. of clayey silt consists of irregularly lenticular layers of sandy clay, sand, gravel and clay to a depth of 80 or 90 ft., where a continuous bottom of clay and sand-streaked clay is found. Above this bottom, except for the topsoil and interspersed lenses of clay, the subsurface is pervious sands and gravel. The dam, therefore, as shown by the profiles, rests on a pervious material throughout both embankment and spillway.

Complete cutoff, by sheeting, of flow under the dam was not attempted. Instead, the piles were driven from the foundation profile to a depth that a 40-ft. pile would

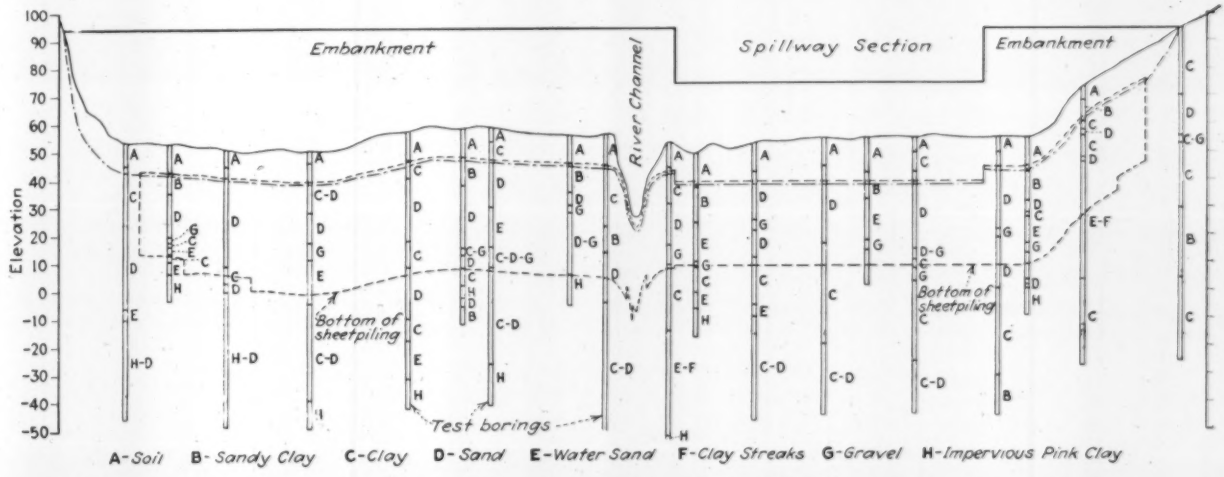


FIG. 4—ACROSS-VALLEY PROFILES OF BORINGS AND DAM STRUCTURE

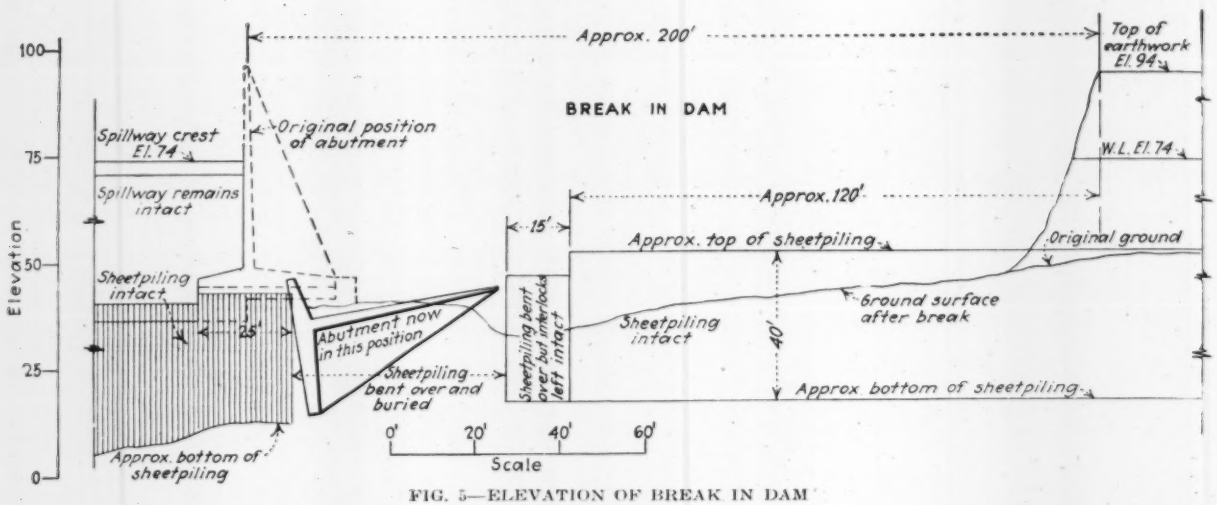


FIG. 5—ELEVATION OF BREAK IN DAM

reach. This depth, with the natural soil covering, which was regarded as virtually impervious, and the impervious backfill behind the spillway section, were considered sufficient to neutralize the head and prevent dangerous pressure and percolation under the dam. Two lines of longitudinal drain pipes were put in under the spillway section to prevent accumulation of pressure. Beyond the backfill extending upstream about 40 ft., as indicated on several of the drawings, the blanket of natural soil was depended upon to seal the reservoir bottom. This blanket, as shown by the borings, was known to be of uneven thickness, but surface inspection indicated no breaks and its sufficiency as a seal was considered ample.

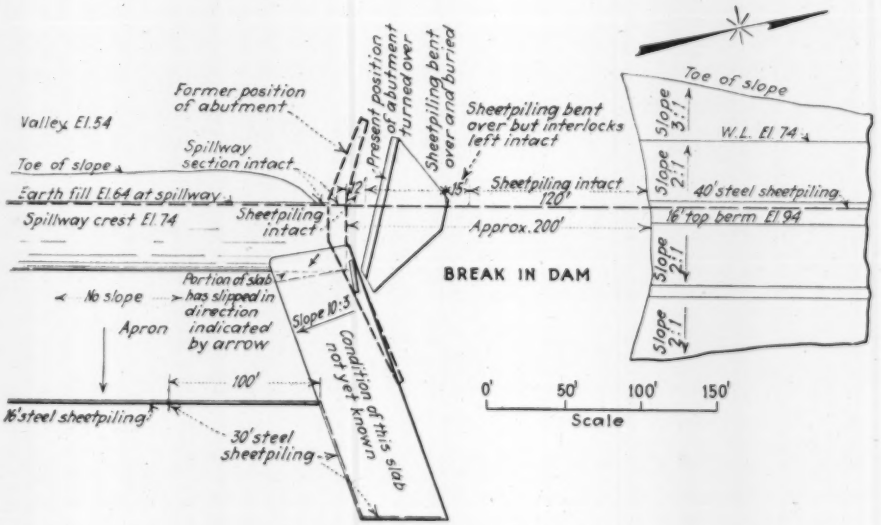


FIG. 6—PLAN OF BREAK IN DAM

Referring again to the section in Fig. 3, the fact is noted that the spillway foundations drop below the bottom of the embankment. Also from Fig. 3 it is noted that the rear wall of the dished bottom of the weir section is 4 ft. higher than the front wall. The dished bottom clears the present surface and rests on pile tops projecting out of the ground. This fact is mentioned because when the abutment wall pulled away from the spillway, as described later, the open space permitted observation of the pile tops and the ground underneath the weir. No disturbance of either was evident for so far as a flashlight made sight possible.

The crest of the spillway, as will be noted from the profiles, is about 20 ft. above lake bottom, and the rear wall foundation is about 15 ft. below lake bottom. The vertical height of crest above rear foundation-wall level is 38 ft., and about 3 ft. greater if measured to the lowest part of the weir section in front. This makes it one of the highest if not the highest of masonry weirs on sand foundations, and, with the unusual dished base contour for a gravity section weir, one of the boldest dam designs ever constructed.

At the time of the failure on Nov. 23 the weir was spilling about 1 in. of water. This was not the first overflow; the weir had been overtopped twice previously and in one of these overflows had been estimated as spilling 18 in. of water. The lake had been substantially full for fifteen to eighteen months. Inspection had been made from time to time and once in particular, when percolation through the earthfill had aroused the concern of the city officials. This percolation was found to be moderate and evenly distributed and of such nature that silting could naturally be expected to close it off. No announced observation of spillway percolation that attracted interest is recorded. The weep holes in the weir, while regularly showing water, were not at any time officially recorded as showing large flow or notable discoloration.

There was no eye-witness of the accident. A man who had been fishing was on the dam just prior to the actual break and described what he saw as follows: Water was boiling up from under the toe of the apron at a point about opposite the abutment. On the lake side upstream from the abutment there was a swirl in the water. As he watched from the dam top near the abutment wall, a crack began to open between the fill and the back of the wall, and he ran back along the dam to the caretaker's house a few hundred feet up the hill. Mean-

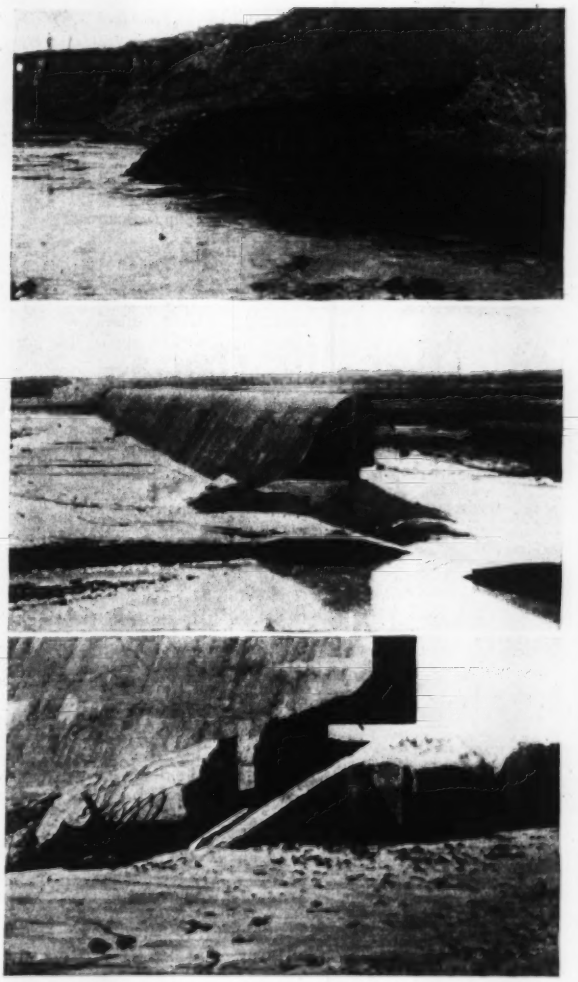


FIG. 7—VIEWS SHOWING DAMAGE TO DAM

while, the abutment collapsed and the water was widening the breach in the embankment. These are the bald facts of the fisherman's tale as originally told; retelling has since developed ornamentation which makes a far more exciting narrative.

The circumstantial evidence which appeared when the lake had run out and as it now appears, is presented by Figs. 5, 6 and 7. Taking the several structural parts separately, the facts are as follows: The abutment had tipped away from the weir section, revolving on its heel, and was lying on its back with its heel footing, counterforts and lower wall buried in the material which had filled the hole scoured by the flood. The toe footing which had pulled out from under the weir section projected above the ground, as did the top of the wall. The block of concrete which had supported the toe footing, Fig. 3, had dropped down out of sight in the cavity, and all but two (near the weir) of the footing foundation piles had washed out. Several of these which had lodged downstream exhibited no damage. The vertical joint between the abutment face and the weir end was bitumen painted and without bond. The fracture where the underside of the weir section connected with the toe footing was clean. Indeed all fractures were clean and indicated excellent concrete. The adjacent apron and the training-wall slab, except at the top, were buried under washed material, and their position and condition were invisible. Large fragments of the tip of the downstream wing-wall footing and of the upper end of the training wall showed clean breaks and very little spalling. Apparently the abutment had tipped over on its heel as it was undermined and had settled into the cavity washed by the flood with remarkably few fractures.

The condition of the sheetpiling is best understood from the sketches Figs. 5 and 6. It had broken interlock at two points and in the gap between had apparently bent over at a depth of some 20 ft., and, so far as a few wash borings had determined when the work was visited, was still in the ground at the bottom. Where standing and visible as exposed by the break, except for a short piece of the end extending out from the bank, the piling was in line and still as vertical as when driven. Like the concrete, the cutoff wall gave evidence of excellent structure.

The structure of the rolled embankment was also excellent, as indicated by the nearly vertical face of the breached fill. Defect of materials and workmanship was not evident in any of the units of the dam structure.

Cause of Failure

The origin and cause of failure are not certain from the evidence available. Possibly future excavation of the buried positions of the collapsed masonry may disclose positive indications, but at present any such evidence is hidden. Abutment masonry, foundation piles, sheeting, training wall and weir apron are largely covered by gravel or sand deposited by the floodflow or have been carried away by the wash of the escaping water. Obviously, water went through or under the structure in the close vicinity of the abutment. The line or plane of initial penetration is pure speculation.

One possibility is that initial penetration occurred from the weir side of the abutment. A possibly significant indication of this is afforded by the stain left on the back of the weir masonry by the earth backfill. The stain of the top of the backfill is a distinct line virtually level

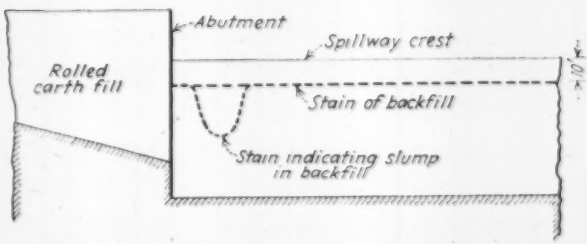


FIG. 8—DIAGRAM OF STAIN LINE ON BACK OF DAM

along the back of the 1,250-ft. weir. At the north abutment, about 5 ft. from its face along the back of the weir, there is a distinct, but less intense, secondary stain about as diagrammed in Fig. 8. The possibility that this stain indicates a funnel-like local sinking of the fill by a downward flowing vein of water which passed under the sheeting and through the abutment piling is obvious. It is one possible conclusion that here was the initial line of penetration, which gradually enlarged and ultimately wrought collapse.

A second possible conclusion is that initial penetration was through the embankment directly back of the abutment. The original lesion may be attributed to several actions: (1) loose compaction of the earthfill close to the counterforted concrete abutment, leaving a zone of

weakness for seepage; (2) unequal settlement of the fill on compressible soil and of the adjacent abutment on more rigid pile foundation, which might produce a line of weakness; (3) penetration under the cutoff or over its top or through the sheeting, along some line of weakness due to unknown cause.

The dam was constructed under a contract by which the contractor received payment as each estimate was due in bonds at face value. These bonds were based on water revenue. Out of each payment the contractor refunded to the city the proportionate fee due for engineering service and the amount of other expenditures made by the city directly for this project. The engineers were selected by the city and prepared plans and specification and supervised construction for a percentage fee.

The dam was completed early this year. Smith Bros., of Dallas, were general contractors, with the Gifford-Hill Construction Co., of Dallas, subcontractor on the earthwork. Hawley & Freese, of Fort Worth, were consulting engineers on the project.

Highway Progress and Investigations

New Facts and Current Problems Outlined at Meeting of Highway Research Board—Capacity of Roads, Causes of Frost Action, Effect of Curing Methods, and Raising Settled Slabs by Mud Pumping Are Prominent Features of Program

LAST of the fall highway events and preceding by only a month the larger gathering at the Road Builder's convention and exhibit in January, the Highway Research Board's meeting at Washington last week gave a general if not wholly balanced view of current matters of road interest. It brought together the accustomed group of technical men concerned in design, maintenance and operation problems. Transportation and construction took most attention, while finance, one of the most active items of present-day road concern, was represented by a single report. Easily the leading items of the program were two papers which reported a new method of raising settled road slabs by mud grouting (Iowa), and the most important study yet made of frost heaving (Michigan).

Research in the narrower sense was represented by half a dozen papers which reported the results of new investigational work, and several committee reports which listed studies that need to be made. About half the program related to general experience and opinion about the construction and use of roads.

Highway Transportation

More definite knowledge of road capacity and transportation cost was given in committee reports by Prof. A. N. Johnson (University of Maryland) and Prof. T. R. Agg (Iowa State College).

Road Capacity—Extensive traffic counts in 51 regions between Washington and Boston, made under direction of Professor Johnson, showed that the lower limit of congestion is at about 1,000 vehicles per hour (total for both directions) on two-lane and 1,600 vehicles on three-lane roads. When four-fifths of the traffic moves in one direction, these figures rise to 1,300 and 2,300.

Transportation Cost—Thorough studies of investment, maintenance and renewal costs as well as traffic volume were carried out by Professor Agg on two pieces of main highway, respectively between New Haven and Bridgeport, Conn., and between Des Moines and Ames, Iowa. On the former, with first cost of $129,000 per mile, including right-of-way and value of prior surfaces as well as construction cost and cost of ten-year renewal, an annual cost of $11,000 per mile was determined; the traffic being 18,500 vehicles per day, the road cost is 0.16c. per vehicle-mile. This is covered about twice by the gasoline tax and registration fees.

For the Des Moines-Ames road, with a first cost of $46,600 per mile and a 25-year life of the surface, the annual cost was found to be $2,620 per mile. The traffic averages 2,500 vehicles per day, or 900,000 per year, making the road cost 0.3c. per vehicle-mile, which is covered by gasoline tax and registration fees.

Other Transportation Matters—Six or eight other papers and reports on highway transportation were presented, dealing with enforcement, safety and financial responsibility among other items. One report brought out that a study of traffic survey methods and forms is being carried out for a committee of the board by the policyholders' service bureau of the Metropolitan Life Insurance Co.

Dr. H. C. Dickinson (Bureau of Standards) emphasized the deficiency in headlights thus:

> Headlights are perhaps the only accessory of the motor vehicle which is condemned by the average user as unsatisfactory and inadequate. The accident rate at night is excessive as compared with that by day, and headlighting is generally held responsible. Information desired: What distribution and beam intensity produced from a practicable bulb candle-power will give the optimum visibility considering all users of the highway?

He also called for better study of the possibilities of overtaking and passing, and for study of ease of steering.

W. A. Van Duzer (Pennsylvania highway department) urged state control of city traffic regulation to the extent of prescribing uniformity of signals. Miller McClintock (Harvard University) recommended uniform specifications for traffic-control mechanisms, and suggested research on capacity, delay, cycle, interval, coordination and administration.

Materials and Construction

Several valuable reports contained results of new investigations into concrete as related to quality of aggregates. A general review of the present status of the subject by F. H. Jackson (Bureau of Public Roads) indicated the need for much research in this field, including study of thermal expansion and freezing.

Flat Particles—Stanton Walker (National Sand and Gravel Association), in tests to reveal harmful effects of flat and elongated particles in coarse aggregate, found that in the quantities likely to be encountered in practice (10 to 15 per cent) such particles do not have a deleterious effect on concrete provided they are themselves of satisfactory quality.

Curing Methods—F. C. Lang (Minnesota highway department) and Fred Burggraf (Highway Research Board) made a progress report on a study of curing methods for concrete slabs. It covered a survey of about 2,000 miles of concrete pavement in five states to determine the influence of curing with wet earth, calcium chloride applied to the surface or integrally, sodium silicate and bituminous covering. The pavements were four to seven years old. Scaling of the concrete surface was not clearly correlated to either age or curing method, but data from one state and one treatment indicated that scaling was proportional to the amount of silt in the sand. Volume and temperature changes of the concrete were greater for bituminous-coated slabs than for others, but were reduced by covering the coating as soon as possible with whitewash or other light-colored material. In three states the average uncracked slab lengths were less for bituminous than for earth curing, while in one state the lengths were as great or greater; all these were for roads without expansion joints. The committee concluded that volume changes are not a factor in deciding on the use of wet earth, calcium chloride surface treatment and sodium silicate; that bituminous coatings result in greater tendency toward shrinkage cracks than wet earth except when properly spaced transverse and longitudinal joints are used; and that when the subgrade is of low frictional resistance or the coating is covered with light-colored material, "shrinkage cracks need not be considered a factor of major importance in considering the use of bituminous coatings as curing agents."

Kansas Concrete Disintegration—Serious corrosion of bridge pier concrete in several Kansas rivers has been studied for a number of years at Kansas State Agricultural College. According to a paper by Prof. C. H. Scholer, these studies show that the trouble has no relation to the alkaline character of the river waters. Natural sand-gravel aggregates are used in much of the region in question, and unsound argillaceous limestone is used in some localities. These materials, lean mixture and bad placing (fill planes, water gain, segregation) were considered to be causative factors in many cases. Field-exposure specimens 10x10x30 in. of various mixtures show disintegration of the lean mixes (1 : 7 and 1 : 9) after five years, and check tests in the laboratory show that twenty freezing cycles break down such concrete, on which basis the better concretes should last 100 to 200 years.

A refrigerator apparatus has been constructed by Professor Scholer which enables three to four cycles per day to be obtained. In this apparatus "poor concrete has been completely disintegrated in twenty cycles and some good mortars have been scarcely damaged at 1,500 cycles. Unsound aggregate can readily be detected either as aggregate or in concrete. Consistent results are secured on successive tests of the same material."

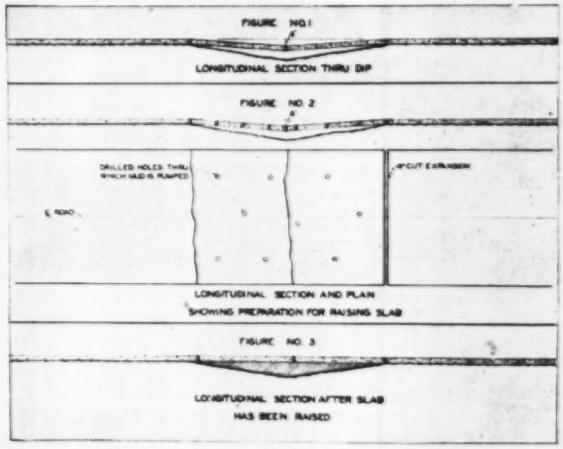
Mixture Design—Bert Myers and Mark Morris (Iowa highway department) described the designing of a concrete paving mixture of 1 : 2.3 : 3.46 proportions, using the natural sand-gravel available in western Iowa, in combination with crushed limestone, to get a 4,000-lb. concrete, and also showed how the strength tests checked the design values. The method uses the Talbot-Richart void theory, but varies it to obtain maximum density of the concrete as placed in the pavement.

Concrete Bridge Design—C. B. McCullough (Oregon highway department), in a paper, "Cost Economies in Concrete Bridges," emphasized (1) the importance of maintenance expenditures on or at bridges, and the need for studying designs with a view to reducing these expenditures, and (2) the economic advantage of rigid-frame structures over articulated (girder-and-pier) structures. He presented a full exposition of the analytical principles by which rigid-frame design can be carried out.

Maintenance

The outstanding maintenance contribution was a description by W. H. Root (Iowa highway department) of a mud-grouting method for raising and rebedding settled pavement slabs. The method has been used extensively in Iowa during the current season. It was invented and is being patented by John Poulter, of the Iowa organization.

In developing the method a hand pump was used, but finally a 20-hp. two-cylinder gasoline pump was built. The mud (a thin mixture of top soil, cement and water)



SECTIONS OF PAVEMENT SETTLEMENT
Showing the Original Condition, the Slab Prepared for Raising and the Condition After the Slab has been Raised.

is mixed to creamy consistency in a mixer tank at the top of the machine and is then forced through a hose into 2½-in. holes drilled through the concrete road slab 4 to 10 ft. apart. A 4-in. expansion joint is cut across the slab at one end of the settled length to give room for the expansion when the slab is raised. The cement in the grout (1 part to 20 of earth) helps to make the grout "set up" or dry out quickly after it is pumped, so that it is less likely to escape through other holes or at the edge. It also reduces the shrinkage of the grout (from 10 per cent to 3½ per cent). During the pumping the gap at the edge of the slab is tamped with earth to keep the grout filling from having free escape.

The delivery hose is 2½-in. high-pressure fire hose with a terminal section of 2-in. steam hose; the latter is stuck into the 2½-in. hole in the slab and is held there by expansion from the mud pressure as soon as pumping starts. Fairly high pressures (sometimes 50 lb. per sq.in.) are required to break the settled slab loose, but the further raising is easy.

With five pumps operating during 1930, Iowa has raised 200 settlements, totaling 9,300 lin.ft.; the raise was 3 in. to 15 in. The cost was $1.02 per square yard of pavement, or $9.88 per cubic yard of material pumped. The pumpage was more than twice the settled volume (1,911 cu.yd., against 899 cu.yd.). Some of the slabs settled slightly after they had been raised, and were again

MUD PUMP FOR RAISING CONCRETE PAVEMENTS

raised to grade by another application of mud pumping, the holes having been left open.

The mud as pumped has a moisture content of about 45 per cent; after two weeks under the pavement it still has about 43 per cent, but apparently it does not flow.

Maintenance Costs and Materials—H. K. Bishop (Bureau of Public Roads) found that different states report maintenance costs of gravel roads at figures ranging from $200 to $2,000 per mile. He urged more uniform cost-accounting methods, but said that the factors influencing costs are so large that figures must be suitably grouped for comparison.

Block Fillers—No ideal brick or block filler is known, according to Prof. J. S. Crandell (University of Illinois), though certain asphalt-sand mastics have been very satisfactory. A service test of various fillers is in progress on the Columbus-Lancaster road in Ohio.

Surface-Treatment Bitumens—A review of tests and qualities of surface-treatment materials by J. E. Myers (New York highway department) indicated that different soil and road conditions call for different qualities, not yet capable or full definition.

Ice Removal—Cinders are considered best as protective covering over ice on pavements, according to B. C. Tiney (Michigan highway department), but tests should be made to compare sand, cinders and chemicals.

Construction Appliances

An extensive review of advances in road construction equipment was presented by a committee headed by J. T. Ellison. In the field of surfacing it reported increase in weight of machines, tendency toward motorizing, lengthening of drags (up to 32 ft.), use of broom drags, and portable crushing and screening plants. In bituminous work, mixers working directly on the road, and spreading and finishing machines are recent developments. In concrete paving the advances include weighed batching, strength design, separating sizes, use of bulk cement, subgrade planers, longer forms, double finishers, high-frequency vibrators, power earth spreaders, shoulder finishers, tandem mixers, and agitator and mixer trucks. Concrete paving records of 140 to 190 ft. per hour have been made as averages of continuous performance, with single days approaching 2,000 ft. of 18- and 20-ft. pavement.

Frost Troubles and Subgrade

Frost damage and related troubles with paved roads have been under study by the Michigan highway department for five years. The results and their application to heave prevention during 1930 were described by V. R. Burton and A. C. Benkelman, of the maintenance forces of the department. The studies were mainly concerned with concrete pavements because the defects are more readily recognized and classified. Field observations and laboratory tests were included. The observations early showed that plastic flow of the soil and expansion due to freezing are major sources of damage, and of these the latter in conjunction with settlement on thawing is most extensive, being responsible for more than half the cases of unsatisfactory pavement condition (both causes are responsible for 75 to 80 per cent).

Freezing observations proved that the moisture in the soil increases during the freezing. In 1929, after a severe winter, some 500 frost heaves were staked out and leveled, and soil studies were later made. These showed that moraine soils were usually involved; that a layer or pocket of fine-textured material surrounded by coarser, better drained soil is a predisposing element (94 cases in 156); and that a small area of silt or very fine sand outcrop in a loam or clay soil is also bad (22 heaves in 156). The average height of heave was 6 in. in silt, 5 in. in very fine sand and silt, 4 in. in very fine sand, 5 in. in silty clay, and 3 in. in sandy clay. Of all the heaves, 80 per cent occurred in cuts, and of these 80 per cent were 4 ft. or more below original ground surface. Silt pockets were found to be much more certain to produce heaves than clay pockets.

The phenomena of freezing were studied in the cold room, and it appeared that variable freezing temperature, which caused the frost line to move up and down in the soil column under test, created water-filled open spaces which led to ice banding, the water being drawn from below. Without such alternate thawing from below, ice plates formed only in soils less than 0.005 mm. in particle size, while the chief sources of trouble in roads were soils above this size, 0.005 to 0.010 mm. in diameter.

Based on these findings, beginning early in 1930 soil surveys were made before construction of pavements, and remedial measures devised to suit conditions. Where silts, silty clays and very fine sands were found they were generally removed and replaced by better material (usually surface soil); sometimes the road grade was raised so as to lie above the bad material. Tile drains were put in at a few points, where the added (coarse) material was surrounded by clay. At pockets of wet clay surrounded by sand, or wet sand over clay, drainage was put in to lower the groundwater, and lateral seepage was intercepted. Of 200 locations treated, drainage was applied at 125. The winter results of this work are to be reported later.

As reported by a committee headed by Thomas H. MacDonald (chief, Bureau of Public Roads), two stud-

ies of finance are in progress, one covering county and township road finance in North Carolina, the other a study of road taxes in relation to property taxes.

As reported by the director of the board, R. W. Crum, current investigations under the board's auspices include: local road finance, analysis of highway costs, methods of determining the economic value of small drainage structures, curing of concrete pavements, mineral aggregates, rail steel, traffic capacity, and traffic survery methods. Many other subjects which are being studied by independent investigators and laboratories are coordinated with the board's program.

Cooperation With Road Builders—A promising development in the plans for future work was agreement with the American Road Builders Association that the two bodies shall cooperate through a joint committee in matters relating to machinery and equipment. This follows the conclusion of a similar agreement between the A.R.B.A. and the American Association of State Highway Officials, and together with it should bring about a better coordination of the three organizations.

Working Stress of 1,200 Lb. Used for 39-Ft. Concrete Slabs

Limited Clearance Necessitates Shallow Floor System for Seattle Viaduct—Unusual Expansion-Joint Details

By Clark H. Eldridge

Junior Bridge Engineer, Office of City Engineer, Seattle, Wash.

REINFORCED-CONCRETE slab construction on 39-ft. spans with concrete working stresses of 1,200 lb. per sq.in. was required by the limited head clearance at the Second Avenue extension viaduct in Seattle. The construction includes the use of several unusual details, including an unsupported expansion joint through a 15-in. slab, using steel dowels and a novel method of supporting the slab on the lower flange of a plate girder. The viaduct constitutes a part of the recently completed Second Avenue extension, built to provide a traffic outlet from the business district of the city to the residential area to the south. The general features of the improvement were described in *Engineering News-Record*, May 9, 1929, p. 745.

The three-way intersection of the new extension with Jackson Street and Fourth Avenue comprises a triangular area about 300 ft. long by 180 ft. wide, covering a series of railroad tracks and loading platforms that made viaduct construction necessary. The vertical clearance, as fixed by the street grade and the railroad tracks, compelled a shallow floor system with span lengths fixed by the requirement of placing rows of columns between the tracks. These supporting bents, extending parallel to the railroad tracks, consist of rolled-steel columns supporting plate girders; the horizontal clearance for these columns was limited to 14 in. This system of bents is at right angles to the line of Jackson Street and on a skew of about 33 deg. with the Second Avenue extension, as shown in Fig. 2.

The major spans as measured between bents along Jackson Street west from Fourth Avenue are: 17 ft. 10 in., 36 ft. 5 in., 39 ft. 0 in., and 20 ft. 10 in. Because

FIG. 1—SECOND AVENUE EXTENSION VIADUCT, SEATTLE, WASH.
Note spacing of supporting columns between tracks. See closeup showing method of attaching slab to girder.

of the limited depth of the floor system, cross girders could not be used, and a slab reinforced in one direction was provided to extend between bents. This slab was designed as continuous over the four spans; the depth was analyzed by the theorem of three moments. This general method was used in the design of the slabs on other portions of the viaduct.

Live load was assumed as two 20-ton trucks with an allowance of 100 per cent on the rear axle of one truck. The working stress in the concrete was taken at 1,200 lb. per sq.in., with 16,000 lb. for the steel. Under these conditions the slab thicknesses for the four spans were 12, 13, 15 and 12 in., respectively. The main reinforcing consisted of $1\frac{1}{8}$-in. round bars at 4-in. centers for

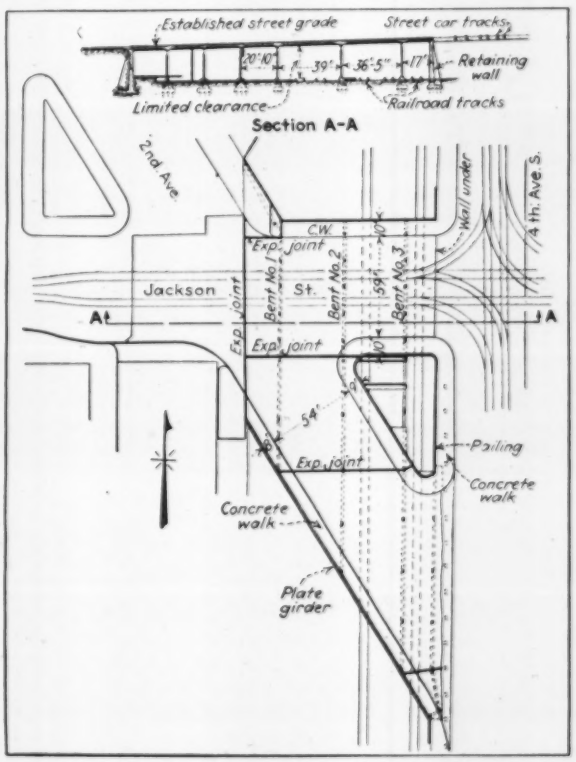


FIG. 2—PLAN OF SECOND AVENUE VIADUCT
Section shows span lengths required and the limited vertical clearance.

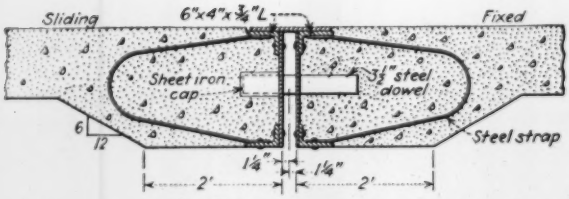


FIG. 3—SECTION THROUGH EXPANSION JOINT

the 36- and 39-ft. spans, with ½-in. round spacer bars at 4-ft. intervals. Slabs for other portions of the viaduct were designed for the same conditions.

The high working stress of 1,200 lb. used for the concrete in these slabs is in accordance with the established practice of this department in reinforced-concrete design. The principle of this economic use of the strength known to exist in concrete is based on designing the concrete for a definite strength and assuming loads as close as possible to actual conditions, including high impact allowance.

In this case the concrete was designed for 3,000 lb. per sq.in. and a fiber stress of 0.4 of this value, or 1,200 lb., was adopted. The concrete mix specified was 1:1¾:3, which provided a cement content of 1.73 bbl. per cubic yard of concrete in place. The strength of the concrete in the structure, as shown by 27 standard test cylinders broken at 28 days, averaged 3,559 lb. per sq.in.; the highest strength shown in the tests was 4,760 lb. and the lowest was 2,830 lb. These values agree with other tests made on similar construction work and, checked with standard tests made at the seven-day period, indicate that the assumed strength was obtained.

Two expansion joints were provided approximately 60 ft. apart at right angles to the supporting bents. These joints necessitated some means of distributing heavy wheel-loads between the adjacent slabs. The method used consisted of incasing the edges of the slabs in steel channel sections, anchored into the edge of the concrete by means of steel straps, and using heavy steel dowels to transmit the loads across the joint. The backs of the channels are spaced to provide a 2½-in. clearance, and the upper edges are covered with the usual checkered plate to allow for expansion movement.

The 3½-in. steel dowels used to distribute the loads between the slabs are spaced at 6-ft. intervals and extend into the concrete through holes in the steel web plates. These pins were 21 in. long; one end was protected by a sheet-iron cap to allow for movement, and the other end was embedded in the concrete of the slab. Details of this expansion joint are shown in Fig. 3.

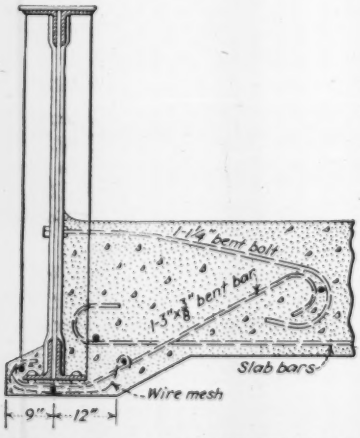


FIG. 4—DETAIL OF SLAB CONNECTION TO GIRDER
Bolt hangers shown in photograph are omitted for clearness.

FIG. 5—SUPPORTING SYSTEM UNDER VIADUCT
Note expansion joint in thickened section of slab.

FIG. 6—METHOD OF CONNECTING SLAB TO GIRDER
See detail drawing for relative position of hooked bars and slab.

Another detail requiring special attention was necessary where the edge of the slab was carried on the lower flange of a through plate girder. The girder formed a support for the end of the slab at a 58-deg. angle with the main reinforcing. Bolts were inserted through the flanges and attached to the web by clip angles to prevent the flanges from bending and to help distribute the load into the web. The girder was stiffended at 6-ft. intervals by 3x⅜-in. steel straps riveted to the lower flange and bent up into the concrete. Additional stiffness was secured at each stiffening angle by 1¼-in. bolts passing through the girder and extending into the concrete as a hooked bar. Details of these stiffening bars and the bolts supporting the flanges are shown in Figs. 4 and 6.

The viaduct has been in use for approximately six months, and measurements taken during that period indicate that the expansion joints are functioning according to the design assumptions. It is believed that this joint design has proved satisfactory.

The Second Avenue extension was carried out under the general direction of W. D. Barkhuff, city engineer. The designs were prepared by the late A. W. Munster, bridge engineer, with the writer acting as his principal assistant. The construction work was done by Nygren Brothers Co., of Seattle, Wash.

News of the Week

New Orleans Bridge Plans Approved by the War Department

MODIFIED plans for the construction of a combination rail and highway bridge across the Mississippi just above New Orleans were approved by the war department on Dec. 15. The bridge is to be built by the Public Belt Commission, an agency of the city. Issuance of a permit was at first refused on the ground that the vertical clearance of 130 ft. above the main channel, as provided in the original plans, would unduly interfere with navigation.

Provision is made in the modified plans for a maximum vertical clearance of 153 ft. above mean gulf level. One other major change in the plans as finally approved authorizes a shifting of the 750-ft. clear channel span from the middle of the river to the west bank. This was done primarily in the interest of navigation, as it was claimed that it would be easier for vessels to follow the bank in foggy weather.

The entire length of the bridge will be 3,525 ft. It will be a combination of cantilever and simple deck trusses. There will be three large spans from the west bank toward the central and more shallow section of the river. The channel span will be 750 ft. and the two other large spans will be 500 ft. each. From the commencement of the deck truss work to the east levee, the spans will have a width of 60 ft. Provision is made for an 18-ft. roadway on each side of the main truss and two railway tracks in the center.

To facilitate the work, the war department has consented to permit construction to be started prior to the approval of plans for the placing of fenders around the piers as a protection to navigation. The new plans provide that suitable fenders shall be built and maintained based upon plans to be submitted to the Chief of Engineers. It is stated that exceptional difficulties will be encountered in the construction of fenders for this bridge because of the great depth of the Mississippi in the vicinity of New Orleans.

GOLDEN GATE BRIDGE, NEAR SAN FRANCISCO, AS IT WILL APPEAR FROM ABOVE

Sketch of the Golden Gate Bridge, on which work will be started early in the spring, according to present plans. This structure, with a span of 4,200 ft., is to be a publicly owned toll bridge to provide a direct highway connection between San Francisco and the district north of the Golden Gate.

Four New York Railroads Agree to Grade-Crossing Elimination

In an effort to speed grade-crossing elimination for the relief of unemployment, acting Governor Lehman, of New York, at a conference with railroad representatives last week won an agreement from four of the railroads under which contracts for new projects totaling nearly $27,000,000 will be advanced within the next year. Those making the agreement are the New York Central, the Delaware & Hudson, the New York, New Haven & Hartford and the Erie. These roads will proceed to award contracts without waiting for the decision on the constitutionality of the Dunmore act, which applies the eight-hour day and prevailing rate of wage laws to crossing elimination work.

Advance Figures for Public Works to Be Undertaken in 1931

VOLUME of public-works construction planned for 1931 rose slightly as a result of the week's returns of the nationwide survey by *Engineering News-Record*. The week's returns, which added 36 per cent to the volume of 1929 and 1931 and 30 per cent to that of 1930 reported the week before, revised downward slightly the extended total for 1929 and raised by 2 per cent the totals for the other two years. The indicated increase over 1930 is 42 per cent and over 1929 is 47 per cent. The present estimate is:

		Per Cent Change From Last Week
1929	$2,705,000,000	—5
1930	2,792,000,000	+2
1931	3,969,000,000	+2

Revised estimates will be published in subsequent issues based on more complete returns.

Chicago City Council Passes State St. Subway Bill

The Chicago city council, by a vote of 40 to 1, on Dec. 15 passed the ordinance for the construction of a subway in State St. to cost $46,000,000. The measure was passed over the protest of a large number of State St. property owners, who have urged changes in the plans. A few minutes after the measure was passed it was signed by Mayor Thompson.

The council's action will cause a contest in the courts, it is expected, by the property owners, who, by the terms of the measure, are to pay 65 per cent of the cost of the subway.

Regional Plan Proposes Reclaiming Hackensack Meadows

Transformation of 30,650 acres of the Hackensack meadows in New Jersey into an industrial center is urged in a proposal presented by the Regional Plan of New York and Its Environs for the consideration of the public and of the New Jersey Meadows Reclamation Commission, which is making an official study of the possibilities of the meadows. By the Regional Plan's proposal, 21,700 acres would be set aside for residential use, 3,990 acres would be allotted to new industries, 4,410 acres would be for parks and other recreational areas and 550 acres would be allotted to business uses.

Construction of Dotsero Cutoff Brought Nearer

Authority to acquire control of the Denver & Salt Lake Railroad by the Denver & Rio Grande Western, through purchase of its capital stock, has been granted by the Interstate Commerce Commission. The acquisition was made conditional on the applicant's beginning construction within 90 days of the Dotsero cutoff on the line of the Denver & Salt Lake, which is to be completed within two years. It is estimated that the construction will take one year and will cost $3,800,000.

Opposition was expressed by the Moffat Tunnel League and the Uintah Basin Railroad League, representing the western counties of Colorado and Utah, both of which contended that service on the Denver & Salt Lake would be impaired if the application were granted.

The commission held that "public interest demands that the cutoff be constructed and brought into operation at the earliest practicable time," and that "its construction ought not to be dependent on whether any particular interest acquires control of the Denver & Salt Lake, nor be affected by litigation as to the terms under which the tunnel may be used."

Report on Cause and Prevention of Unemployment

Suggested measures for the prevention of the four chief types of unemployment are given in a report of the governor's commission on unemployment problems for the State of New York, issued by Frances Perkins, state industrial commissioner and a member of the special commission. The four types are listed as seasonal, cyclical, technological and chronic. A summary of possible measures of preventing seasonal unemployment is given as follows: stimulating consumer and dealer demand during the off-seasons; scheduling production so that employment will be fairly evenly distributed throughout the year despite fluctuations in sales; developing side-line and filler products for slack seasons; and using a flexible working day rather than alternately hiring and firing workers.

According to the report, cyclical depressions are beyond the power of industry to prevent. As a means of affording some relief to cyclical unemployment, the commission suggests that public works be planned far enough ahead and flexible enough to be pushed forward in times of depression of private industry. Technological unemployment, or that caused by replacing of hand labor with machinery, can be lessened by the adoption of sound plans to take care of those released, either by absorption in other departments or by providing dismissal wages large enough to tide the worker over until other work can be obtained. When it is necessary to reduce the working force because of changes in the plant, it is suggested that it be done gradually, not by layoffs, but by non-replacement of losses due to death or superannuation. Chronic unemployment could be relieved by the organization of competent state and national agencies, which could centralize applications for men and work. Such a plan would free workers from the high fees charged by private agencies and would tend to remove the abuses now prevalent in the private agency system of supplying workers.

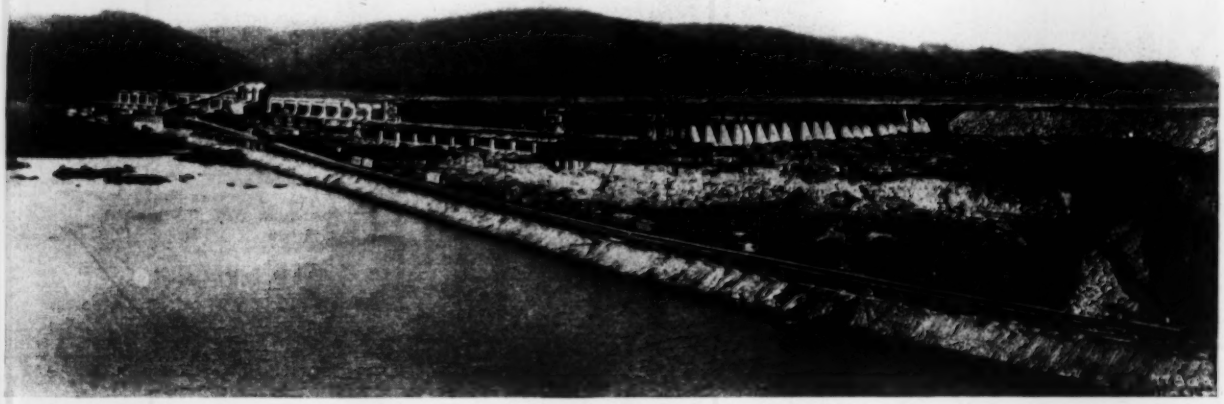
Delay of License Law Legislation Asked by Joint Committee

Postponement of all legislation bearing upon the registration of architects and engineers until after its report is submitted is asked by the joint committee of architects and engineers set up recently to attempt to iron out the difficulties which have caused friction between the two professions. While the points at issue between the two professions are being considered by the committee, its members feel that no new legislation should be passed now which might add fuel to the fire.

The joint committee was set up by the American Institute of Architects and the American Society of Civil Engineers, the American Institute of Electrical Engineers and the American Society of Mechanical Engineers. The architects are represented by J. Riely Gordon, C. Herrick Hammond, John Hall Rankin and D. Everett Waid, chairman; the engineers by W. T. Chevalier, Robert Ridgway, Harry A. Kidder and F. A. Molitor, chairman.

Large Construction Program Sanctioned by Austria

A large construction program has been sanctioned by Austria, which will be financed by the international loan recently obtained. The program includes a hydro-electric power plant on the Danube near Persenburg to develop ultimately 110,000 hp.; a new bridge across the Danube near Ybbs, and a new electric railway line crossing Austria from north to south from Gemund to Graz, to cost approximately $18,000,000 and including 26 tunnels through the Alps.



DEVELOPING THE SUSQUEHANNA RIVER AT SAFE HARBOR, PA.

Rapid progress is being made in the construction of the 255,000-hp. (ultimately 510,000 hp.) hydro-electric plant of the Safe Harbor Water Power Corp., located on the Susquehanna River 17 miles above the Mason-Dixon line. This dam will provide a head of 53 ft., which will later be increased to 55. Of the 450,000 cu.yd. of concrete which will be poured, more than 135,000 is already in place. In this view, taken from the east bank looking upstream, the concrete plant containing four 2-cu.yd. mixers appears at the left. Behind it is the nearly completed bulkhead, or non-overflow, section of the dam, situated on an island in midstream. Further to the right appears the steel construction bridge which carries four gantries and three standard-gage railroad tracks. Excavation for the draft tubes is in progress in the right foreground, where the power house will be located. Behind this is a rockfill breakwater and concrete and steel skimmer wall inclosing the forebay. River flow, during this stage of construction, is carried through a section of the original river bed along the west bank, at the extreme left.

American Construction Council Urges Rebuilding Slums

As a permanent measure for prevention of unemployment and for temporary relief in the present emergency, the American Construction Council, in a letter to the governor of each state and mayors of cities of more than 100,000 population, urges the rebuilding of slum or obsolete tenement districts in all cities. The council believes that this is one of the greatest potential fields of building construction for the coming decade and should furnish many billions of dollars of new construction and employment to thousands of workers, as well as invaluable social benefits. The letters carry the warning that certain safeguards and standards must be provided, including proper regional planning and possible revision of existing building codes and enactment of necessary permissive legislation.

Railroad Officials Inspect Pier

More than 60 representatives of Eastern railroads on Dec. 11 visited a new pier being constructed by the Erie Railroad at its Weehawken, N. J., yard. Light weight is the outstanding feature of the new structure, which is entirely supported by the skin friction of timber piles. These are cut off at low water mark to support a wooden deck upon which is placed a cinder fill, supported by concrete retaining walls, and a concrete floor for the main deck of the pier. A steel superstructure supports two additional decks, the flooring of which is of a new lightweight steel construction not previously used in any other structure. Arched steel plates, in cross-section resembling a large channel, are riveted directly to steel floorbeams. The plates support a 1½-in. mastic flooring. The total weight of this floor is 40 lb. per square foot, and it is designed for loads of 320 and 200 lb. per square foot on the first and second floors, respectively.

The party gathered at the invitation of George S. Fanning, chief engineer of the Erie Railroad Co., and C. I. Auten, vice-president of the Truscon Steel Co., which developed the new type of floor. Foley Bros., Inc., New York City, is the general contractor for the pier.

Vehicular Tunnel Proposed at Los Angeles

Tentative plans for a proposed vehicular tunnel under Cerritos channel, connecting Terminal Island with the mainland, have been submitted to the Los Angeles board of harbor commissioners. The plans were prepared by George F. Nicholson, harbor engineer, and provide for a concrete tube 5,375 ft. long. The estimated cost is $6,250,000. The tunnel would relieve motor car and truck traffic congestion in the harbor area. The height of the tube would be 40 ft. and the width 38 ft. Plans call for a two-way, 25-ft. driveway in the center, with sidewalks on either side. A bascule bridge now carries traffic across the channel, and this bridge would be retained for railroad traffic.

Cement $2.40 at New York Dock

Price of cement, alongside dock, New York, was reduced 3c. per barrel to $2.40 on Nov. 13, the first price change in a year. This is the price to contractors and dealers. The dealers' price delivered on the job is $2.10, unchanged since July. Mill prices are $1.85 at Hudson, N. Y., and $1.75 at Northampton, Pa., unchanged in a year.

Rubber Paving Blocks Used on New Jersey Bridge

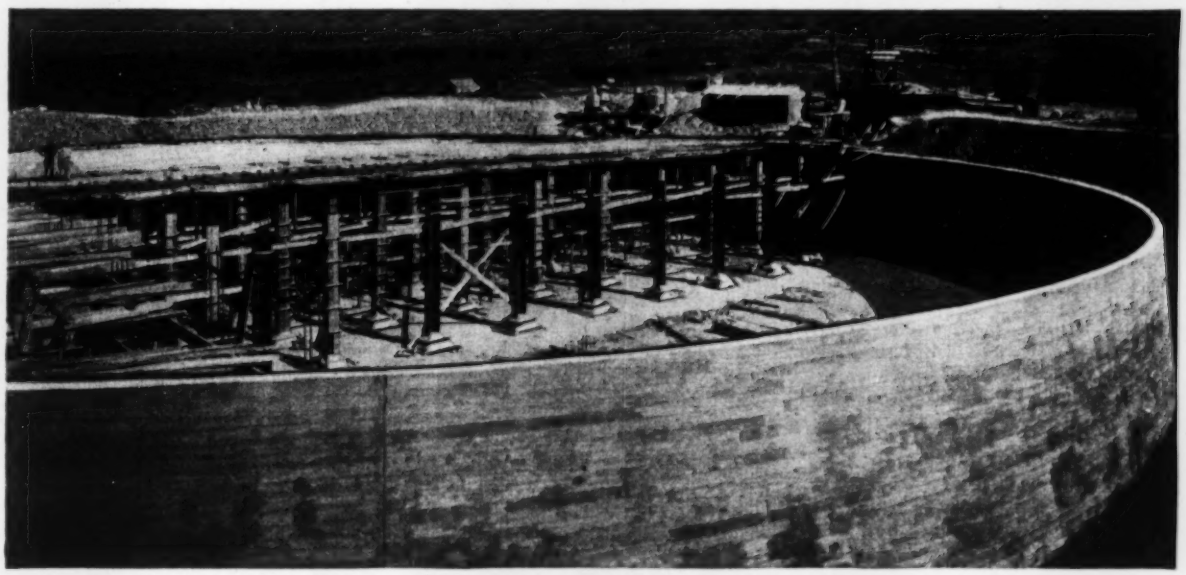
One section of a bridge across the Passaic River at Passaic, N. J., comprising about 400 sq.yd., has been paved with rubber blocks as a test of this type of paving material. The structure was opened to traffic on Nov. 25. The blocks used, in plan, are hexagonal, measuring 8 in. between parallel sides. They have a total thickness of 1½ in., half of which consists of a set of protruding lugs which are embedded in the 3-in. cement mortar base paving of the bridge deck. The top of each block is scored with diagonal lines to form a non-skid surface. During the process of laying, the edge of each block is painted with rubber cement.

The pavement was laid for the county of Passaic, N. J., under the direction of Garwood Ferguson, county engineer. F. W. Schwiers Co., New York City, was the contractor. The rubber paving blocks were supplied by the United States Rubber Co., of Passaic.

Drought Effects Discussed at Water-Works Meeting

The drought of the past two years and its effect upon water supplies was a subject of discussion at the meeting of the New England Water Works Association in Boston Dec. 10. H. B. Kinnison, district engineer of the U. S. Geological Survey, presented tabular data of precipitation and runoff showing that conditions in general nearly as bad as in 1908 have occurred. He also called attention to the fact that drought conditions have not ended, so that the eventual results are likely to exceed those of 1908 in severity.

For the year ended June 30, 1930, precipitation upon the Wachusett drain-



COVERED RESERVOIR FOR PROVO, UTAH

Construction of the 5,000,000-gal. covered reservoir for the city of Provo, Utah, is nearing completion. The reservoir has a diameter of 200 ft. and a depth of 20 ft. of water. It is constructed of reinforced concrete.

age area was only about 29.5 in., or 65 per cent of the normal, the lowest year of record. The runoff for this year was 0.74 sec.-ft. per square mile, or only 44 per cent of the average. Unless conditions change materially the Wachusett reservoir will reach its lowest level since 1908. At Lowell, Mass., precipitation for this same yearly period was 26.62 in., the lowest since 1836.

Arthur D. Weston, director and chief engineer of the state department of health, considered that for the past few months evaporation from water areas has been unusually great, thus affecting water supplies even more than the run-off records indicate. Shortage of water has occurred in 24 municipal supplies in Massachusetts, requiring emergency measures. The drought has especially affected supplies from wells.

Superintendent George A. King, of the Taunton water-works, stated that Assawompsett Pond, the city's source of supply, was lower by 6 in. than at any time during the past 37 years.

Illinois Contractors Discuss Highway Problems

Announcement of a $45,000,000 state road program in Illinois for 1931 was made by Frank T. Sheets, state highway engineer, at the annual meeting of the Illinois Association of Highway and Municipal Contractors, held in Chicago on Dec. 10 to 12. Of this amount $15,000,000 is for work let recently and $30,000,000 is for work yet to be let. The state has built 7,630 miles of road by bond issues and still has 2,200 miles to build within the next three or four years. During 1930 about 785 miles has been paved by the state and 224 miles by the counties. In his address Mr. Sheets also answered criticisms of the department methods, showing that the methods criticised are those specified by the road law, so that steps to change the law are more logical than are complaints of its administration.

Requirements for prequalification of contractors have not entirely eliminated failures to complete contracts, said Mr. Sheets, but the amount of paving rejected is very small, showing that the work is done thoroughly and conscientiously. Supervision of county road work by the state, as now required, is highly desirable to insure uniformity. But expenditure of gasoline tax funds on township or farm roads is undesirable, since the money is furnished by motor travel and should be used on roads commonly used by such travel, which is not the case with township roads. An attack on the state gasoline tax law, by John P. Hart, corporation counsel of Aurora, Ill., consisted largely of criticisms of the highway department, which were among those answered by Mr. Sheets.

County and secondary roads were discussed at one session by R. L. Schoenberger, president of the Illinois Association of County Superintendents of Highways, and A. E. Carter, county superintendent of highways for Winnebago County. Other subjects included bituminous surfaces by A. H. Hinkle, maintenance engineer of the Indiana state highway department; prequalification of contractors, by C. E. Myers, director of city transit, Philadelphia, Pa.; and contractors and sureties, by E. A. St. John, National Surety Co., New York.

WASHINGTON NOTES

By Paul Wooton
Washington Correspondent

Bill Authorizes $125,000,000 for Federal-Aid Highways—Bureau of Agricultural Engineering Proposed

IN THE agricultural department appropriation bill reported to the House of Representatives on Dec. 16 a total of $125,000,000 for the federal-aid highway system is authorized. This is carrying out the enlarged program begun by Congress last April, to continue for three years, to add $50,000,000 to the usual $75,000,000 appropriation.

Thomas H. MacDonald, chief of the Bureau of Public Roads, has recommended that the government be authorized to extend greater aid to states where construction costs are so high that the $15,000 a mile limitation restricts the amount such states may obtain.

Federal Power Commission Nominees Questioned

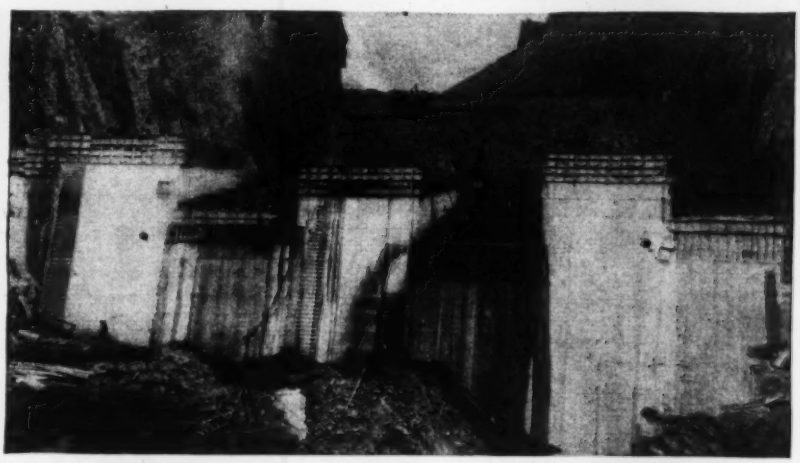
Indications at this writing are that a new Federal Power Commission will be functioning within a week. Confirmation of four of the five nominees seems a certainty. George Otis Smith, nominated to be chairman of the commission, has been questioned by the interstate commerce committee of the Senate as to his views on public or private operation of water-power projects, but Senator Wheeler, of Montana, was the only member of the committee to vote against reporting in favor of his confirmation. Only perfunctory questions were asked of Claude L. Draper, of Wyoming, and Ralph B. Williamson, of Oregon. There is some political opposition to Frank R. McNinch, of North Carolina, and Marcel Garsaud, of Louisiana, but Senators Wheeler, Dill, Brookhart and Howell cast the only votes against Mr. Garsaud in committee. No committee vote has yet been taken on Mr. McNinch.

New Bureau Proposed

The agricultural engineering division of the Bureau of Public Roads is advanced to the status of a bureau by the agricultural department appropriation bill and is given an appropriation of $583,000. According to a statement by Mr. MacDonald, 40 state agricultural colleges believe that the establishment of such a bureau would be of material advantage in maintaining co-operative relations.

Interstate Bus Bill Lags

Members of the Interstate Commerce Commission will be called before the Senate committee in charge of the interstate bus bill to discuss the sections of the measure dealing with railroads, it was decided at a meeting of the committee on Dec. 15. The bill, which already has passed the House, was scheduled to be voted upon in the Senate during the first week of the present session. Because of the inability of Senators to agree on the manner of dealing with railways owning bus lines and also because of the desire of other Senators to include interstate truck traffic in the regulations, a motion was sustained to recommit the bill.



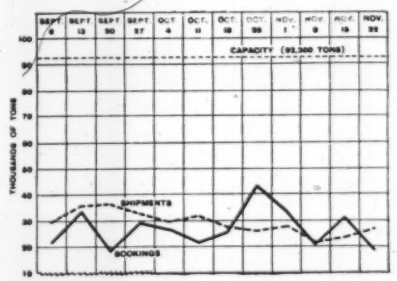
CONSTRUCTION PROGRESS ON THE OWYHEE DAM

Placing 47,000 cu.yd. of concrete during October, the General Construction Co., Seattle, Wash., has completed more than 50 per cent of the construction work on the Owyhee dam, being built for the Bureau of Reclamation on the Owyhee River in eastern Oregon. In addition to work on the dam, tunnel driving on the distribution system will be pushed throughout the winter. About 600 men are employed in constructing the project.

12 Weeks' Sales of Fabricated Structural Steel

The department of commerce, which has issued monthly bookings of structural steel sales since 1913, has supplemented this service with data showing the movement by weeks. The accompanying chart shows the trend from Sept. 6 to Nov. 22.

The number of establishments reporting bookings varies from 123 to 121 Sept. 6 to Oct. 18, and 119 to 108 Oct. 25 to Nov. 22. Percentage of bookings



FABRICATED STEEL BOOKINGS AND SHIPMENTS SEPT. 6-NOV. 22, 1930

to the capacity of the plants was 29 to 71; their capacity to total capacity of all plants in the United States, 49 to 69 per cent.

Shipment tonnages were reported by 119 to 111 plants to Nov. 8, and 107 and 104 in the weeks of Nov. 15 and 22 respectively. Percentage of shipments to capacity of these plants was 53 to 75; percentage of total capacity for the country, 48 to 52.

For the year 1929 bookings averaged 78 per cent of capacity, shipments 72. Bookings have declined steadily since July, 1930, and shipments since June.

Quebec Streams Commission Shows Profitable Year

Because of the constant demand for water-power developments the activities of the Quebec streams commission last year were extensive. Expenditures of the commission during the year totaled $245,672 and receipts were $751,993. Receipts from the St. Maurice River alone totaled $300,115, while operations cost $31,556. In general, according to the annual report of the commission, the main rivers of the province have been made easier to exploit and more productive of water power. Through its extensive services the commission has been able to collect interesting statistics, among others some regarding the snowfall in the period from October, 1928, to June, 1929, inclusive. The average snowfall, recorded in inches at the various dams, was 112.25 in. At the Gouin dam 143.50 in. fell. The commission has succeeded in regulating the flow of water in summer and winter without interruption, thus assuring operation of public utilities without interference from the snow and ice or from overflooding.

The Business Outlook

Week by week business bumps along the rocky bottom of the valley looking forward grimly to the new year, expecting nothing more of this one, and getting it. The last months of depression are the toughest but so is business sentiment by that time, and it becomes pretty hard to disappoint it any more. Basic industrial production continues to decline, along with freight movement, while retail trade rises, all according to the calendar but hardly according to the requirements of a merry Christmas. What lies beyond the turn of the year becomes no easier to see clearly.

—The Business Week, Dec. 17.

Concrete Pavement Yardage

Appended below is a tabluation of concrete pavement yardage awarded during the month of November, 1930, and also the total number of square yards awarded for roads, streets and alleys in the United States for the year 1930 to date as of Nov. 29.

	Sq.Yd. Awarded During Nov. 1930	Sq.Yds Awarded From Jan. 1, 1930 to Nov. 29, 1930
Roads	4,790,288	102,924,371
Streets	1,371,475	31,801,552
Alleys	130.989	2,285,965
Totals ...	6,292,752	137,011,388

Canadian Railways in Air-Rail Transportation Hook-Up

Following out the preliminary plans as forecast in announcements several months ago, both the transcontinental railway companies in Canada have now definitely entered the aviation arena in a rail-air line hook-up destined to be of great importance in the development of transportation in Canada. Through a recent order-in-council passed by the Canadian government, the Canadian National Railways has been enabled to participate with the Canadian Pacific Railway, Western Canada Airways, Ltd., and the Aviation Corporation of Canada in the formation of a large company to be known as Canadian Airways, Ltd., the president of which is James A. Richardson, of Winnipeg, head of the grain exporting firm of James Richardson & Sons. During the past three or four years Mr. Richardson has been prominently identified with aviation development in Canada as the proprietor of Western Canada Airways. More than 2,500,000 miles have been flown so far by the planes of this company, operating in all sections of the country, from Ontario to the Pacific Coast and far north in the Arctic Circle. The activities have included transportation of more than 40,000 passengers, mining equipment and explorers' supplies, reconnaissance work, photography, dusting of crops and forests, fisheries' patrol and forest fire patrol.

Construction Machinery Exports Exceed Those for 1929

Despite the depression, exports of construction and conveying machinery for the ten months ended with October were slightly in excess of the value of exports during the corresponding ten months of 1929. The figure for the first ten months of 1930 is $122,934,859. In October the value of such exports was $1,450,985, which is a continuation of the rate maintained in September, but in October of 1929 comparable exports were valued at $1,941,827.

As compared with last year there were increases in exports of excavators, cranes with swinging booms, and conveyors. The other items showed small decreases.

The detailed figures as taken from returns to the U. S. Bureau of Foreign and Domestic Commerce, follow:

	October, 1930	September, 1930	October, 1929
Excavators, including power shovels	$529,769	$446,221	$406,749
Excavator parts and accessories.....	223,249	199,363	258,176
Dredging machinery.	57,398	32,123	84,800
Concrete mixers.....	48,850	50,606	96,349
Road rollers.....	9,629	6,000	14,437
Road graders.....	47,482	24,087	48,519
Other road-making equipment.....	90,210	73,335	95,346
Other construction equipment.....	47,673	49,597	59,116
Cranes with swinging booms	50,697	103,517	39,550
Other cranes	36,308	151,485	114,129
Monorail hoists.....	.....	2,245	900
Other hoists.....	93,942	172,488	152,483
Derricks, except mining.....	8,195	8,208	48,590
Elevators, freight and passenger.....	46,727	84,898	74,782
Conveyors, bucket, chain or belt	31,259	31,203	26,033
Other conveying equipment.....	136,597	145,497	421,858

Two High Concrete Records

Information has been received from the Dnieper power dam by Hugh L. Cooper, consulting engineer for the work, that during the 1930 concrete placing season (beginning about the middle of April and ending Dec. 4) a total amount of 670,000 cu.yd. of concrete was placed, which means a sustained average of more than 85,000 cu.yd. per month. This work was done with two mixing plants, each equipped with eight mixers. The mix was relatively dry, and placing was done by bucket.

A closely similar record was made at the Bagnell dam of the Osage Power Co. in Missouri. A. A. Northrop, of Stone & Webster, reports that during the past five months a sustained average of 85,000 cu.yd. was placed, with one mixing plant containing four 2-yd. mixers. On this work cement is delivered in bulk and is handled by belt. Concrete is chuted, the chutes being supported directly by traveling gantries on a construction bridge extending along the dam.

Brief News

ENGINEERS and architects in Ohio have formed an organization to urge upon the next session of the legislature the enactment of a bill licensing persons practicing those professions.

RESTRICTIONS on the use of water have gone into effect in Baltimore, Md., with but 100 days' supply in the reservoir. A number of smaller Maryland cities have been restricting consumption for months, their water supplies affected by the drought.

THE NEW NINTH AVE. PIER in Brooklyn basin, Oakland harbor, Calif., was recently completed. The pier, erected at a cost of $1,250,000, is 1,521 ft. long and 224 ft. wide, with a single transit shed 504 ft. long and 180 ft. wide. The cargo capacity of this shed is 20,000 tons and of the open wharf 40,000 tons.

ORDERS for the first material to be used in the construction of the transmission line to be erected by the Southern Sierras Power Co. to Boulder Dam to furnish power for its construction have been placed by the power company. These orders are for 5,000,000 lb. of fabricated steel pole line structures, and deliveries are to be made at Torrance, Calif., between Dec. 15, 1930, and March 15, 1931.

Personal Notes

FREDERICK O. ANDEREGG, formerly associate professor of physical chemistry at Purdue University and more recently senior industrial fellow at the Mellon Institute of Industrial Research, in charge of investigations of portland cement and masonry, announces the opening in Pittsburgh, Pa., of an office for consulting practice on building materials, including portland cement, cement products and masonry.

ARTHUR E. GORMAN, formerly chief sanitary engineer in charge of chlorination control for Chicago, has resigned his position of sanitary engineer with the Wallace & Tiernan Co. to become Western representative of the Pardee Engineering Co., Inc., maker of chlorine apparatus, with headquarters in Chicago. Mr. Gorman was awarded the Diven medal by the American Water Works Association in 1928 for outstanding service to the association.

RUSSELL G. CONE, who was resident engineer during the construction of the Philadelphia-Camden bridge and of the Ambassador Bridge at Detroit, has been retained as resident engineer to take charge of work in the field when construction of the Golden Gate Bridge at the mouth of San Francisco Bay is started.

F. J. ALTVATER, who has been associated with the office of the city highway commissioner in Denver, Colo., has been appointed manager of city parks and improvements, succeeding C. D. Vail, who was appointed chief engineer of the Colorado state highway department. Mr. Altvater has been affiliated with the city government for more than twenty years.

J. E. BLANCHARD, chief engineer of Montreal, has been appointed engineer of the Metropolitan Commission in place of H. A. Terreault, former chief engineer of Montreal.

ALFRED BRAHDY, designing engineer of the New York city board of transportation, has been granted a leave of absence to act as resident representative of Robert Ridgway, consulting engineer for the proposed Chicago subway system.

EVERITT W. WILSON, formerly vice-president of R. W. Hebard & Co., Inc., of New York, and later foreign representative for the J. G. White Engineering Corporation, also of New York, is now associated with the Winston Brothers Co., Minneapolis, Minn., as representative for the negotiation of contracts outside of the United States.

CHESTER T. DIKE, engineer of maintenance, Chicago & Northwestern Ry., has been appointed chief engineer, to succeed the late Walter J. Towne.

THOMAS J. JONES has been named city engineer for New Iberia, La.

Society Calendar

AMERICAN ROAD BUILDERS ASSOCIATION, Washington; annual convention and road show, St. Louis, Mo., Jan. 10-16.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; annual meeting, New York, Jan. 21-23.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Washington; annual meeting, San Francisco, Jan. 26-28.

ENGINEERING INSTITUTE OF CANADA; annual meeting, Montreal, Feb. 4-6.

NATIONAL CRUSHED STONE ASSOCIATION, Washington; annual convention, St. Louis, Mo., Jan. 19-22.

NATIONAL PAVING BRICK ASSOCIATION, Washington; annual meeting, Pittsburgh, Pa., Feb. 4-6.

NATIONAL READY MIXED CONCRETE ASSOCIATION, first annual convention and exhibit, St. Louis, Mo., Jan. 26.

NATIONAL SAND AND GRAVEL ASSOCIATION, Washington; annual convention, St. Louis, Mo., Jan. 27-29.

AMERICAN STANDARDS ASSOCIATION at its annual meeting in New York on Dec. 11 elected as president Bancroft Gherardi, vice-president and chief engineer of the American Telephone & Telegraph Co., and reelected as vice-president Cloyd M. Champan, consulting engineer, New York City.

INDIANA HIGHWAY CONSTRUCTORS, INC., at its recent convention in Indianapolis, adopted resolutions urging establishment of a minimum wage for all public works and indorsing government relief movements. Officers elected were: president, F. A. Gast, Warsaw; vice-president, Edgar Traylor, Evansville; secretary, Edward F. Smith, Indianapolis; executive secretary, W. M. Holland, Indianapolis.

MADISON-ST. CLAIR DIVISION, Illinois State Society of Engineers, has elected officers as follows: president, S. F. Wilson, Signal Hill; vice-president, J. E. Schwaab, Alton; secretary-treasurer, A. A. Coleman, East St. Louis.

TACOMA SECTION, American Society of Civil Engineers, at its meeting on Dec. 8 elected the following officers: president, J. L. Stannard, chief engineer, public utilities, city of Tacoma, reelected; vice-president, R. K. Tiffany, Sr., of Tiffany & Langloe, consulting engineers, Olympia; secretary-treasurer, Julian Arntson, senior engineer, city engineering department, Tacoma, reelected. A committee was appointed to gather data for the President's emergency committee on unemployment. The section placed itself on record as favoring the bill providing for licensing of engineers in the State of Washington. This bill will come before the legislature in January.

THIRTEENTH TEXAS WATER WORKS SHORT SCHOOL will be held Jan. 20-23 in Waco. C. C. Hays is secretary of the local committee and V. M. Ehlers is secretary of the Texas section, Southwest Water Works Association.

Obituary

THOMAS G. FORSCHNER, president of the T. J. Forschner Contracting Co., Chicago, died Dec. 12. He had handled a number of large public works, including the recently completed west side sewage-works of the Sanitary District of Chicago.

FRANK KURTH, pioneer contractor, of Gary, Ind., died recently in a hospital there following an illness of five weeks. Brought to this country by his parents when six months old, he had lived in the Calumet region of Indiana for 70 years.

W. HARRY RISHER, city engineer of Brazil, Ind., and in charge of the municipal utilities there, died recently following an operation. He was graduated from Purdue University and served as a member of the faculty there. He had worked in Arkansas and Kentucky, but for the last several years had lived in Brazil.

JAMES E. MCNAMARA, president of the McNamara Construction Co. and one of the most prominent contractors in Indianapolis, died recently at his home of heart disease, aged 65 years.

THEODORE EICHHORN, superintendent of the department of streets and public improvements of Erie, Pa., died on Nov. 23. Mr. Eichhorn was the second president of the International Association of Public Works Officials.

ANDREW MURRAY HUNT, civil, electrical, mechanical and chemical engineer, died in Berkeley, Calif., Dec. 8 at the age of 71. Mr. Hunt was graduated from the Naval Academy at Annapolis in 1879. While in the navy he was loaned by the government to San Francisco to become chief of the department of mechanical arts at the Mid-Winter Fair in 1894. Following the fair he left the navy and became a consulting engineer in San Francisco. He acted as consulting engineer for Claus Spreckels in the erection of a plant for the Independent Electric Light & Power Co., San Francisco, of which he became general manager. In 1904 he founded the firm of Hunt, Mirk & Co. For two years he devoted his entire time to the business of the firm and following that acted in an advisory capacity until 1913, when the business was sold. Mr. Hunt then continued as a consulting engineer, spending part of his time in New York City. During the last few years of his life he did not maintain offices. He was a member of the American Society of Civil Engineers, and was vice-president during 1921-22.

Construction Equipment and Materials

317 Exhibitors Now Listed for St. Louis Road Show

Figures released by the American Road Builders Association show that space allotments have already been made to 317 exhibitors at the 28th annual convention and road show to be held at St. Louis, Mo., Jan. 12-16, 1931. The exhibit this year will be more diversified than it was last year, as many new developments have occurred in the equipment field. For example, the show will contain the first general exhibition of motor freight equipment that has been made as a unit. Because of the bright prospects for road and street construction in 1931, the association expects a record attendance. Reduced railroad fares have been obtained for the convention. Hotel reservations are in the hands of a housing bureau located at the Jefferson Hotel, St. Louis.

Pneumatic Conveyor Patent Held to Be Void by Supreme Court

In a decision handed down Dec. 15 the U. S. Supreme Court upheld the action of the District Court for the Western District of Washington in declaring void the patent held by the Concrete Mixing and Conveying Co., Chicago, Ill., covering the conveying of concrete by compressed air.

New Developments

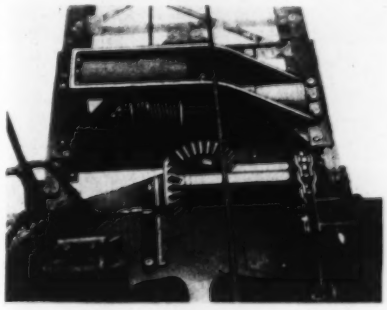
Wood and Rock Combined to Form Fireproof Insulation

Waste lumber, shredded into long tough fibers and mixed with a binder of calcined magnesia, is used to form a lightweight building insulation by the Thermax Corp., 1411 Fourth Ave., Seattle, Wash. Although known in continental Europe for the past twelve years, this material has not previously been manufactured in this country. Thermax can be used as sheathing, as a base for stucco or plaster, to form light partitions or as roof insulation. When laid on rafters 2 ft. 8 in. on centers, the heavier slabs will, according to the manufacturer, carry a load of over 400 lb. per sq.ft.

Advantages claimed for the new material include the following: light weight, high resistance to the transmission of heat or sound and freedom from attack by fire or vermin. The slabs have a density of 27 lb. per cu.ft., and have an over-all conductivity of approximately 0.13 B.t.u. per hour per square foot per degree temperature change as compared with a value of 0.23 for walls of ordinary wood sheathing and wood lath construction. Thermax is furnished in blocks 20 in. wide by 48 in. long in 1-, 2- and 3-in. thicknesses. Longer or shorter lengths can be furnished on specification.

Auxiliary Drum on Crane Gives Close Control of Load

Both present and outstanding models of Thew-Lorain crawler and locomotive cranes can be equipped with a new precision two-speed hoist line control which has been developed by the Thew Shovel Co., Lorain, Ohio. Use of this device gives accurate control of the hoist line for final positioning of the load, without danger to either load or workmen from sudden surging or dropping due to grabby clutch action. In applying the device to a crane, the hoist line is fastened, as usual, to the standard hoist



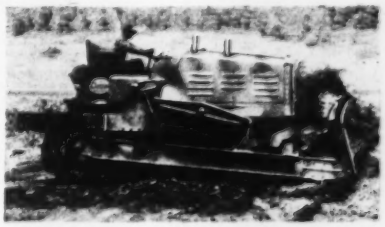
SLOW-SPEED HOIST DRUM ON BASE OF CRANE BOOM

drum, and then is reeved over the head of the boom, down through the snatch or hoist block, back over another sheave at the boom point and then down to the secondary hoist drum, located at the base of the boom. The cable is dead-ended on this drum, which can be driven in forward or reverse direction through the use of the standard shovel crowding mechanism on the travel shaft, a set of cut miter gears and an oil-inclosed self-locking worm drive. By using the crowd and retract lever, the small drum can be revolved slowly in either direction under positive power control. When the control lever is in neutral, the worm gear acts as an automatic lock, which is supplemented by an automatic brake applied to the crowd shaft.

In operation, loads are hoisted by the standard hoist drum to approximate position, then the hoist brake is set and the secondary drum is used for final adjustment. The small amount of power required to actuate the secondary hoist permits idling the engine, which gives an auxiliary hoist speed of only 3½ ft. per minute, and a lowering speed of 7 ft. per minute.

Large Bulldozer Attachment

For attachment to the Cletrac model 80-60 tractor the Essex Engine & Machine Corp., Belleville, N. J., has de-



HYDRAULIC BULLDOZER ATTACHMENT

signed a heavy-duty bulldozer with a blade 7 ft. long and 48 in. high and an approximate weight of 7,000 lb. As is shown in the illustration, the blade is controlled, through a system of side linkage, by a hydraulic pressure cylinder connected to a pump mounted on the power take-off of the tractor. The total over-all length of the attachment is 15 ft. 2 in.

Heavy-Duty Electric Shovel of 3-Cu.Yd. Capacity

Digging tests have just been completed by the Marion Steam Shovel Co., Marion, Ohio, on the first machine to be completed of its new type 4120 shovel dragline, a 3-cu.yd., full-revolving, close-coupled electric machine. While

HEAVY-DUTY 3-CU.YD. ELECTRIC SHOVEL

the fundamental design of the unit follows basic Marion principles, a number of new and improved features have been incorporated. The crawlers are fully inclosed, with treads of manganese steel. The lower frame is a one-piece steel casting, and the propelling gears underneath the frame are fully inclosed. The outside, or well-type, boom and the inside dipper handle are used, with the customary Marion triple hitch on the hoist cable. An inclosed cab and powerful spotlight equipment add to ease in operation.

Air Compressor Added to Crane

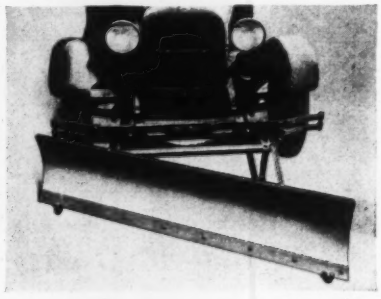
Numerous construction and maintenance jobs require the intermittent use of hoisting machinery and air compressors. By combining these two elements into a single, compact, mobile unit Frederic H. Poor, Inc., 342 Madison Ave., New York City, has produced a combination which can be used in many different fields. The basis of the machine is the Loadmaster 3,500-lb. crane

COMPRESSOR ATTACHMENT BUILT ON LIGHT TRACTOR CRANE

with 10-, 12- or 14-ft. revolving boom, mounted on the McCormick-Deering 10-20 industrial tractor. To this has been added a 160-cu.ft. air compressor mounted on the rear of the tractor, the air tank being carried on the left side. Compressor capacity is sufficient, according to the manufacturer, to run three paving breakers, four riveting hammers or two rock drills. Advantages of the combination unit include easy portability, at a maximum speed of 10 m.p.h., between jobs; maximum utility, since the machine can be used as either hoist or compressor; and freedom from the necessity for long lengths of air hose.

Snow Plows for Light Vehicles

Three types of snow plows which can be quickly attached to passenger cars or light trucks are being marketed by the snow plow division of the Empire Plow Co., Cleveland, Ohio. One of these, the model 78 auto snow shovel, is a light, straight-blade plow which will push the snow straight ahead or to either side and can be carried on the bumper of the car from one job to another. It is made for use on smooth surfaces at low speeds. For heavier duty, the company recommends the model V-81 "V" plow, which has road-grader steel blades and is patterned after the large, heavy road and street plows in common use. This attachment is recommended for continuous heavy use on roads and streets too rough for the smaller unit. A somewhat different purpose is served by the speed plow, the third model, which is designed for the purpose of enabling cars and

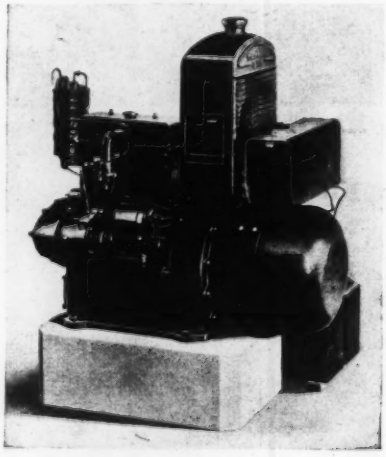


AUTOMOBILE SNOW SHOVEL

trucks to travel over unopened roads that would otherwise be impassable. This plow does not touch the ground, but is carried on the car like a bumper. It rides axle-high, and removes the upper layer of snow down to the axle level.

Electric Plant Does Double Duty

By building in a small two-tray 32-volt rubber cell battery in its new model D-32 electric plant, the Kohler Co., Kohler, Wis., makes possible a combination service—current for a small number of lights without operation of the plant, and power for heavy-duty service provided by the automatic starting of the generator. From seven to twelve 25-watt lamps can be supplied from the



1½-KW. ELECTRIC GENERATING PLANT

battery. When the current demand exceeds 300 watts, however, the plant starts automatically and the load is shifted from the battery to the generator. Should the load be reduced to 200 watts, the motor stops and current is again taken from the battery. The entire operation is automatic. The plant has a total capacity of 1½ kw., and will operate motors up to 2 hp.

New Publications

Pipe Tools—Improvements which have been made in the line of pipe tools manufactured by the BORDEN CO., Warren, Ohio, are outlined in a recent 4-p. illustrated folder.

Sewage Pumps—Non-clogging pumps for sewage handling and drainage with capacities from 200 to 4,000 gal. per minute are described in a 24-p. bulletin 126, of the CHICAGO PUMP CO., 2336 Wolfram St., Chicago, Ill.

Cement—"How to Make Good Waterproof Concrete" is told in a 28-p. bulletin published by the MEDUSA PORTLAND CEMENT CO., Cleveland, Ohio. Specifications are given for waterproofed concrete foundation walls, basement floor slabs and concrete exposed to the elements.

Explosives—"Explosives as a Civilizing Force," a radio talk recently delivered by Julius Klein, assistant secretary of commerce, has been reprinted by the INSTITUTE OF MAKERS OF EXPLOSIVES, 193 Park Ave., New York City.

Steel Flooring—Engineering data and price lists on continuous steel flooring are contained in a folder compiled by the IRVING IRON WORKS CO., Long Island City, N. Y.

Inspection—"The Protective Value of Independent Inspection," an 8-p. publication of the PITTSBURGH TESTING LABORATORY, Stevenson and Locust Sts., Pittsburgh, Pa., discusses the practical value of the work done by the modern testing laboratory. After a general introduction, the subject is subdivided as it affects steel fabrication, erection and welding, cement tests, concrete construction and lumber.

Centrifugal Pumps—Type SSU centrifugal pumping units, in which a single ball-bearing-mounted shaft serves both an electric motor and a centrifugal pump, are described in bulletin 1647 of the ALLIS-CHALMERS MFG. CO., Milwaukee, Wis.

Aggregate Handling Equipment—Mining, quarry and gravel plant machinery, including crushers, screens and grizzlies, washers and rewashers, vibrators, elevators and conveyors are described in a new bulletin 266-G, published by the SMITH ENGINEERING WORKS, Milwaukee, Wis.

Reinforced Brickwork—Mathematics of design of reinforced brickwork, in which tension steel is used in a manner similar to reinforced concrete, are discussed in a recent bulletin published by the COMMON BRICK MANUFACTURERS ASSOCIATION OF AMERICA, Cleveland, Ohio. While the use of this type of masonry is practically unknown in this country, it is commonly accepted practice in India and China. The information in this bulletin is based upon a technical paper published by the department of public works of the government of India.

Costs and Contracts

E. N.-R. Index Numbers

Cost			Volume		
Dec. 1,	**1930**	**196.86**	**Nov.,**	**1930**	**207**
Nov. 1,	1930	198.54	Oct.,	1930	211
Dec. 1,	1929	209.46	Nov.,	1929	245
Average,	1930	202.85	Average,	1929	317
Average,	1929	207.02	Average,	1928	287
1913		100.00	1913		100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Dec. 18, with some comparisons, total as follows:

(In Thousands of Dollars)

	Dec. 18, 1930	Average of Last Four Weeks 1930	1929
Buildings:			
Industrial	$2,306	$2,880	$9,686
Other	23,147	16,819	19,189
Streets and roads.	8,039	7,423	4,932
Other eng. constr..	21,991	14,628	9,529
Total	$55,483	$41,750	$43,337

Total, all classes Jan. 1 to Dec. 18:

1930 ..... $3,140,496

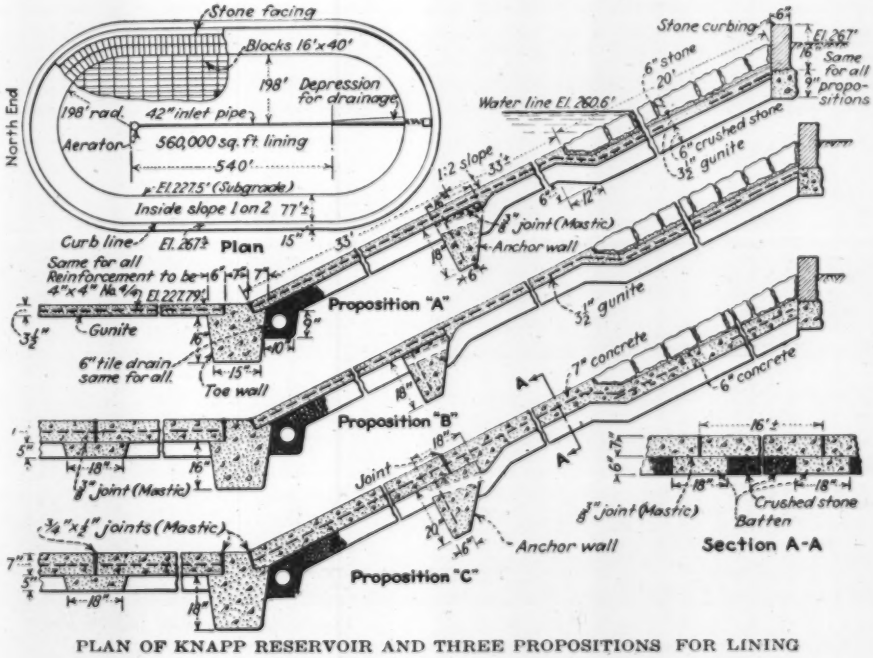
1929 3,931,578

Unit Prices From Current Construction Bids

Lining Syracuse Reservoir With Gunite

KNAPP reservoir in Syracuse is being lined with gunite. Bids were asked for three propositions, as shown in the drawings: A, all gunite; B, concrete slab on bottom and gunite lining on slopes; C, concrete slab lining on bottom and slopes. Ten bids were received, and unit prices are given of the lowest two: A, I. M. Ludington's Sons, 215 Powers Bldg., Rochester (contract awarded in July, 1930, on proposition A, all gunite), for $271,258; B, Walter S. Rae.

	A	B
570,000 sq.ft. grading for lining	$0 06	$0 0593
400 cu.yd. removal of spoil	50	1 00
300 cu.yd. excav. and refill below subgrade	3 00	6 00
226,000 sq.ft. crushed stone lining on slopes	06	08
2,820 lin.ft. stone curbing (com. limestone)	3 25	
2,820 lin.ft. stone curbing (granite)	3 00	2 90
56,000 sq.ft. stone facing (com. limestone)	75	
56,000 sq.ft. stone facing (granite)	75	65
2,350 lin.ft. 6-in. tile drain	25	40
300 lin.ft. 3-in. tile drain	10	40
600,000 sq.ft. steel fabric reinforcement	065	055
10,000 lb. steel rod reinforcement	05	05
720 lin.ft. delivering and placing c.-i. pipe	6 00	1 25
Construction aerator (lump sum)	2,500 00	1,500 00
Total, limestone	$146,963	
Total, granite	146,258	$135,619
Proposition A		
560,000 sq.ft. 3½-in. gunite slab	$0 14	$0 159
100 cu.yd. reinf.-conc. Class A	20 00	15 00
350 cu.yd. conc. Class B	16 00	13 00
15,000 bbl. portland cement	2 60	2 80
Total	$125,000	$137,090
Proposition B		
337,000 sq.ft. con. slab lining on bottom	$0 175	$0 22
226,000 sq.ft. gunite slab lining on slopes	146	182
100 cu.yd. reinf.-con. Class A	20 00	15 00
1,350 cu.yd. con. Class B	13 50	9 00
20,000 bbl. portland cement	2 60	2 50
Total	$164,196	$178,922
Proposition C		
560,000 sq.ft. concrete slab lining bottom and slopes	$0 16	$0 22
100 cu.yd. reinf.-con. Class A	20 00	15 00
1,800 cu.yd. con. Class B	12 00	10 50
22,500 bbl. portland cement	2 60	2 50
Total	$171,700	$199,850
Totals proposition A (limestone)	$271,963	
(granite)	271,258	$272,709
Totals proposition B (limestone)	$311,159	
(granite)	310,454	$314,541
Totals proposition C (limestone)	$318,663	
(granite)	317,958	$335,469



PLAN OF KNAPP RESERVOIR AND THREE PROPOSITIONS FOR LINING

New York Approaches to Hudson River Bridge

IN THE summer of 1929 four contracts were awarded on the approaches to the Hudson River bridge between Fort Washington and Fort Lee. Unit prices of Contract HRB-10, for the New Jersey approach, were presented in the July 17 issue, p. 119. The three other contracts, covering the New York approach, were: (1) HRB-6 for main approach ramp; (2) HRB-8 for vehicular tunnel in West 178th St.; (3) HRB-9 for the Riverside Drive connections.

TABLE I—MAIN RAMP

	A	B	C
18,000 cu.yd. excav.	$1.50	$5.89	$7.00
15,000 cu.yd. conc., except items marked*	16.40	12.96	13.00
22,500 bbl. cement, mixed in conc., as above	2.50	2.35	2.50
340 cu.yd. granite, except pavement	170.00	193.00	180.00
5,500 sq.yd. granite-block pavement, inc. mortar bed	5.00	5.65	7.25
700 cu.yd. rubble-masonry walls	18.00	10.80	14.00
140 cu.yd. rubble-masonry facing	40.00	16.20	25.00
3,400 sq.ft. hollow tile walls	40	.50	.65
49,000 sq.ft. gunite walls*	.90	.90	.90
11,000 sq.ft. gunite coating*	.30	.30	.27
2,100,000 lb. structural steel	.055	.044	.0417
1,600,000 lb. reinforcing rods	.05	.049	.05
83,000 lin.ft. reinforcing trusses	.20	.25	.25
4,300 lb. cast steel	.15	.20	.10
49,000 lb. cast iron except pipe	.06	.12	.04
24,000 lb. wrought-iron pipe	.06	.25	.17
180 lin.ft. 16 in. cast-iron pipe	8.00	7.00	8.00
250 lin.ft. 24 in. cast-iron pipe	13.00	10.00	10.00
1,010 lin.ft. 3 ft. 6 in. x 2 ft. 4 in. conc. sewer*	14.00	15.85	15.00
7,800 lin.ft. 3½-in. fibre conduits	.35	.45	.20
2,700 lin.ft. 3½-in. galv.-steel conduits	1.50	1.66	1.50
1,200 lin.ft. 3 in. galv.-steel conduits	1.40	1.15	1.20
Totals	$746,679	$771,102	$781,625

The main approach ramp, 980 ft. long and extending from the anchorage in Fort Washington Park, consists of a 196-ft. reinforced-concrete arch, a steel and concrete structure 500 ft. long, and a 200-ft. open cut. There are two types of rubble masonry: solid rubble gravity walls and rubble masonry for facing concrete retaining walls. Gunite walls 2 in. thick and reinforced with galvanized wire mesh are constructed along the sides of the ramp west of Northern Ave. During the construction of these walls, gunite coating ½ in. thick is applied. The walls are constructed in coats of ¾ in., 1 in. and ¼ in. The reinforcing trusses are 6 in. deep, and the top and bottom chords have a net section not less than 0.6 sq.in., section through web members, 0.65 sq.in. per linear foot of truss.

Nine bids were received, and the principal unit prices are given of the lowest three: A, Cornell Contracting Corp. (contract); B, George Colon Construction Co.; C, Poirier & McLane Corp.

The tunnel, 2,000 ft. long with roadway 22 ft. wide, is built by the cut-and-cover method. Eleven bids were received; unit prices are given of the lowest two: A, Cornell Contracting Corp. (contract); B, Arundel Corp.

The Riverside Drive connec-

Unit Prices From Current Construction Bids

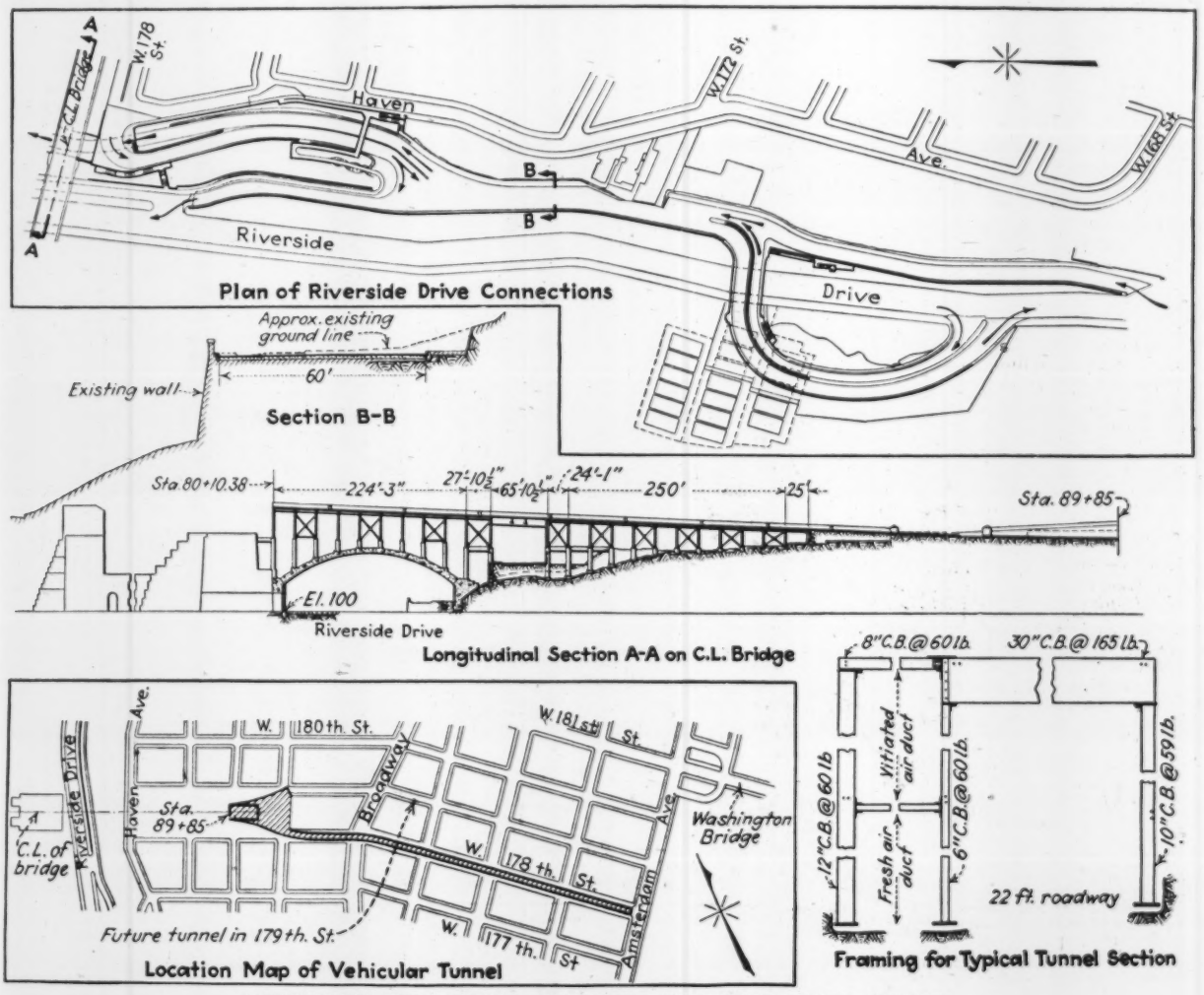
tions consist of roadways which will separate onbound and offbound bridge traffic and eliminate all intersections at grade. Pavement is granite block, sheet asphalt and asphalt block. The block pavement consists of a mortar bed and a wearing surface of granite blocks with bituminous joint filler. In the asphalt pavement the binder course and the wearing surface is each 1½ in. thick. The asphalt blocks, 12x5 in. by 3 in. deep, are laid on a 1½-in. bed of mortar. Twelve bids were received. Unit prices are given of the lowest three: A, William P. McGarry; B, Leonard Paving Co.; C, George Colon Construction Co., Inc.

TABLE II—VEHICULAR TUNNEL IN WEST 178 ST.

	A	B
131,000 cu.yd. excavation	$5.80	$5.12
6,700,000 lb. structural steel	.05	.046
25,000 cu.yd. concrete, except items marked*	11.00	15.70
42,000 bbl. cement, mixed in concrete as above in items*	2.50	2.63
70,000 sq.ft. precast concrete forms*	.35	.39
1,300 lin.ft. 39-in. precast concrete-pipe sewer*	11.00	10.00
1,000 lin.ft. 3 ft.-6 in. by 2 ft.-4 in. concrete sewer*	15.00	20.00
2,100 lin.ft. 24 in. vitrified-pipe sewer	13.00	4.95
300,000 lb. cast-iron pipe†	.06	.046
400,000 lb. reinf. rods, except in items* and †	.05	.0435
120,000 lb. reinf. mesh, except items* and †	.15	.062
300 lb. bronse	2.00	1.00
50,000 lb. iron and steel castings, except in items marked†	.13	.125
17,000 lb. galv. iron boxes and covers†	.35	.10
8,700 lin.ft. 1 in. galv. steel conduits	.35	.44
100 lin.ft. 1¼ in. galv. steel conduits	.50	.62
1,700 lin.ft. 2 in. galv. steel conduits	.75	.81
4,500 lin.ft. 2½ in. galv. steel conduits	.80	1.00
1,200 lin.ft. 3 in. galv. steel conduits	1.50	1.40
300 lin.ft. 4 in. galv. steel conduits	2.00	2.00
12,600 lin.ft. 4 in. fibre conduits	.50	.37
17,000 sq.yd. three-ply membrane waterproofing	2.00	1.83
800 sq.ft. asbestos lumber	.50	1.00
12,500 sq.ft. sheeting left in place	.01	.19
6,500 lin.ft. granite curbing	4.00	4.70
1,800 lin.ft. new bluestone curbing	3.50	3.10
2,000 lin.ft. salvaged bluestone curbing	2.00	1.90
17,000 sq.yd. sheet-asphalt pavement with concrete base	2.00	4.06
3,000 sq.yd. concrete sidewalks	3.50	3.10
Totals	$1,756,945	$1,768,709

TABLE III—RIVERSIDE DRIVE CONNECTIONS

	A	B	C
70,000 cu.yd. excavation	$2.37	$1.50	$3.31
39,000 cu.yd. fill west of Riverside Drive	0.30	1.00	0.10
14,600 cu.yd. concrete	12.20	15.25	15.10
28,000 bbl. cement, mixed in concrete	2.15	2.65	2.40
1,300 cu.yd. granite	157.85	149.00	45.00
1,000 cu.yd. rubble-masonry walls	10.89	12.10	8.10
1,950 cu.yd. rubble-masonry facing	15.96	17.50	16.00
9,900 sq.yd. granite-block pavement	6.23	6.65	6.50
8,300 sq.yd. sheet-asphalt pavement	1.84	1.35	1.50
7,100 sq.yd. asphalt-block pavement	3.23	4.15	3.00
23,000 sq.yd. concrete pavement, base on subgrade	1.50	2.25	1.50
12,000 lin.ft. 5 in. granite curbing	2.13	3.30	2.80
140 lin.ft. resetting salvaged blue-stone curbing	2.20	2.00	1.50
2,500 sq.yd. concrete sidewalks on subgrade	2.50	5.15	2.20
1,600,000 lb. reinf. rods	.045	.065	.049
10,000 lb. wrought-iron drainage pipe	.11	.15	.08
Totals	$995,969	$1,062,656	$1,082,069



DETAILS OF NEW YORK APPROACHES TO HUDSON RIVER BRIDGE

CONSTRUCTION NEWS

Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue.

Location	Project	Cost	Status
Sewers			
Dallas (Tex.)	Sewage disposal plant	$1,700,000	Proposed
Bridges			
San Francisco	Bridge	35,000,000	Bids asked
Chicago	Bridge	10,000,000	Proposed
Streets and Roads			
Alabama	Roads	4,679,000	Bids asked
South Carolina	Roads	5,000,000	Bids asked
Excavating and Dredging			
Toronto (Ont.)	Sea wall	1,300,000	Proposed
Grade Crossings			
Minneapolis	Grade crossing	4,000,000	Proposed
Subways and Tunnels			
Brooklyn	Subway	3,652,383	Contract
Long Island City	Subway	3,505,000	Contract
Piers and Wharfs			
Montreal	Wharf	1,000,000	Bids asked
Airports			
New Orleans	Airport	1,000,000	Proposed
Factories and Mills			
Santa Ana (Calif.)	Plant	1,000,000	Proposed
Austell (Ga.)	Thread plant	2,000,000	Proposed
Buildings			
Wichita (Kan.)	Hotel	1,500,000	Contract
New York	Apartment	1,000,000	Contract
New York	Apartment	1,000,000	Contract
Oklahoma City	Hotel	2,000,000	Contract
Syracuse	Office	1,500,000	Contract
Baton Rouge	Capitol	2,950,987	Contract
Pasadena (Calif.)	Auditorum	1,000,000	Bids asked
Chicago	School	1,810,829	Contract
Petersburg (Va.)	College	1,000,000	Proposed

WATERWORKS

PROPOSED WORK

Calif., Fairfield—Preparing estimates new c.i. mains, valves, fittings, steel tank, installing well and pump, replacing outfall sewerage system. To exceed $25,000. Election soon to vote on bonds for same. A. M. Jensen, 68 Post St., San Francisco, engr.

Calif., Turlock—For 5th auxiliary pumping plant in connection with municipal waterworks, J. Brown, city supt. waterworks.

Conn., New Haven—New Haven Water Co., 100 Crown St., 600,000 gal. water tower, steel, 50 ft. diam., 50 ft. high, at Shingle Hill and Jones Hill Rds., West Haven. $15,000. Private plans.

Ind., Marion — Constructing 14 watermains, $20,000. Address City Clerk.

Kan., O'athe—Preliminary plans waterworks improvements, distribution system, $42,000.

N. Y., Goshen—Village, auxiliary reservoir for water supply. $300,000.

Kan., Olathe — Waterworks improvements, $42,000.

Tex., Fort Worth—City, c/o O. E. Carr, mgr., plans complete about Jan. 1, brick, rein.-con. filtration plant addition, 39 x 65 ft. administration building, 39 x 107 ft. filter building, 55 x 65 ft. chemical building, 138 x 310 ft. sedimentation basin, 5 m.g. covered clear well, aeration chamber, 100,000 gal. capacity wash water tank, steel tank, brick covered, steel roof trusses. D. L. Lewis, city engr. Hawley, Freese & Nichols, 411 Capps Bldg., consult. engrs. Noted Sept. 18.

Wash., LaConner—New waterworks, $45,000 bonds voted for same.

Ont., Sandwich — Town, 1¼ mi. 6 in. c.i. mains in Partington, Euclid and Sunset Aves., King and Queen Sts. $43,000. C. R. McColl, Pitt St., Windsor, engr.

Ont., Chatham—City, extending waterworks, incl. 1¼ mi. 6 in. c.i. mains. $23,870. T. M. S. Kingston, City Hall, engr.

Ont., Toronto—Scarboro Twp., water tunnel, shaft and pipe line to pump house. $48,000. R. Harrison, 1662 Kingston Rd., engr.

Que., Hull—E. B. Eddy Co. Ltd., V. M. Drury, pres., preparing plans and takes bids early in 1931, water filtration plant. Private plans.

BIDS ASKED

Calif., Long Beach—See "Streets and Roads."

Calif., Redlands — City Council taking bids 300 lb. pressure, 900 g.p.m. direct connected 60 cycle booster pump, motor.

Calif., Redwood City — City Council taking bids furnishing 6 and 8 in. pipe in connection with waterworks extensions. Total $17,500. C. L. Dimmitt, city engr. Noted Dec. 4.

Calif., Sacramento—H. G. Denton, city clk., taking bids one hundred twenty-five 4 in. and fifty 6 in. gate valves.

D. C., Wash.—Dec. 29, at office Washington Suburban Sanitary Comn., Tower Bldg., 14th and K Sts., 75 tons c.i. fittings for water pipe, Contr. 83-W. R. B. Morse, Hyattsville, Md., district ch. engr.; adv. E. N.-R. Dec. 18.

Mass., Fall River—Dec. 23, by City, rein.-con. found., for steel tank, Emmett St. $20,000. Private plans. Noted Dec. 11

Mass., Salem—See "Contracts Awarded."

N. J., New Lisbon — Dec. 26, by Bd. Freeholders Burlington Co., Mount Holly, A. Adams, clk., 16 in. well, equipped with electrically operated vertical submerged type turbine pumps, pipes and appurtenances, at Burlington County Institutions, Remington, Vosbury & Goff, 509 Cooper St., Camden, engrs.

N. Y., Brentwood—Jan. 14, at office Dpt. Mental Hygiene, State Office Bldg., Albany, water supply, at Pilgrim State Hospital. F. W. Parsons, comr.; adv. E. N.-R. Dec. 18.

N. Y., New York — Dec. 23, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Prospect Ave. and East 176th St., Bronx Boro.

N. Y., St. George—Dec. 19, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Carlton Blvd., Grymes Hill Rd., Acacia, Armstrong, Elmwood, Holly, Olympia, Ramblewood and Rathbun Aves., Engert, Hillcrest, Jay, Oakdale, 1st, 2nd, 3rd and 5th Sts., Richmond Boro.

Wash., Tacoma—City Council bids about Feb. 8, 19 in. main in Yakima Ave. from South 19th St. to Division Ave. $49,507. Noted Nov. 20.

B. C., Vancouver—Jan. 5, by City Council, 1,000 standard hydrants, 5 to 18 in. hub end gate valves. $50,000. C. Brackenridge, City Hall, engr.

Ont., Preston—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Beverly Hills—B. J. Firminger, city clk., Water Treatment Plant 2, to H. M. Baruch Corp., Lincoln Bldg., Los Angeles, $36,866. Noted Nov. 27.

Calif., Coalinga—E. J. McCroskey, city clk., 5,000 ft. 3 in. welded pipe, to Hickey Pipe & Supply Co., Coalinga, at $36 cwt. Noted Nov. 27.

Calif., Los Angeles—City Water & Power Dpt., to Western Pipe & Steel Co., 5717 Santa Fe Ave., 34,920 ft. 51 in. welded steel pipe at $6.20 per ft., 240 ft. 33 in. $5.20, 96 ft. transitions $10.80; to American Hume Steel Pipe Corp., Box 1428 Arcade Station, 2,448 ft. 18 in. welded steel water pipe with centrifugal concrete lining double dipped in Wailes-Dove Hemniston Corp. hermastic pipe coating $2.90, dipped in McEverlast Inc. coating $2.86; to American Concrete Pipe Co., 4635 Firestone Blvd., 1,824 ft. 30 in. centrifugally cast cement concrete pipe $3.81, 384 ft. 42 in. centrifugal concrete pipe $4.58, 744 ft. 33 in. $3.25, 304 ft. 24 in. $2.03, 160 ft. 21 in. $1.71.

Conn., Litchfield — Litchfield Water Co., reservoir, to C. Da Ross, Litchfield. Est. exceeds $15,000.

Mass., Hanson — Town, Water Comrs., G. Bowker, chn., extending mains, to Federal Contg. Co., 52 Summer St., Stoneham. Est. $85,000. Noted Dec. 11.

Mass., Marblehead — Town, laying 16 in. mains, Contrs. 2 and 3, to G. Ferullo, Inc., 15 Piggott Rd., Medford, and to Zoppo & Civitarese, 480 Metropolitan Ave., Hyde Park. Noted Nov. 13.

Mass., Salem — City, 16 in. watermain in Loring Ave., day labor. $15,000-$20,000.

Mich., Flint — City, furnishing, installing centrifugal pumps and motors for waterworks pumping station extensions, to DeLaval Steam Turbine Co., North Clinton Ave. and Pennsylvania R.R., Trenton, N. J., $16,300. Noted Dec. 11.

N. J., Woodcliffe—Boro Council, water distribution system, to J. Burns, Park Ave., Dumont, $35,000. Noted Nov. 27.

N. D., Minot—City, G. A. Reishus, aud., improving waterworks, to Kemper & Huston, Minot, $47,000. Noted Nov. 20.

Okla., Holdenville—J. Kirk, city clk., earthen dam, pipe line, incl. 300,000 cu.yd. excav., to J. J. Harrison, Lindsay, $124,385 est, $150,000; concrete spillway, lake site clearing for city reservoir, to J. J. Votaw, Holdenville, $35,835 est, $50,000. Noted Nov. 20.

Wash., Olympia—City Council, installing two 250,000 gal. water tanks for reservoirs in city water works, to Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa., $22,250. Noted Dec. 4.

Ont., Preston—Town Comn., watermains, reservoir, day labor. $37,000. James, Proctor & Redfern, 36 Toronto St., Toronto, engrs. Noted Nov. 6.

Ont., Stoney Creek—Village, 30,000 ft. c.i. waterworks, to A. Cherico, North Bay; supplying c.i. pipe, to Gartshore-Thompson Pipe & Fdry. Co., Stuart St., Hamilton. Est. $50,000.

SEWERS

PROPOSED WORK

Ill., La Salle—City Council preliminary plans sanitary sewerage system. $284,400. C. DeLeuw & Co., 111 West Washington St., Chicago, engrs.

Ind., Seymour—Storm and sanitary sewer, $92,000. C. Mathes, Seymour, engr.

Ia., Hopkinton—Sewage disposal plant, 20,000 ft. sanitary sewers. $30,000. W. E. Buell Co., Insurance Exch. Bldg., Sioux City, engrs.

N. J., Emerson—Bd. Boro Council, Boro Hall, sewerage system, disposal plant, $250,000. T. F. Bowe, 110 William St., New York, engr. **Maturity in spring, 1931.** Noted Mar. 13.

Tex., Dallas — City, c/o E. Goforth, secy., equipment specifications for sewage disposal plant, incl. 2 bar screens, 2 primary clarifier equipments, 5 final clarifier equipments, 4 digesters, 6 air compressors, complete about Jan. 1. General plans ready about March. $1,700,000. W. S. Tanner, Dallas, sewer engr. Hawley, Freese & Nichols, 411 Capps Bldg., Fort Worth, consult. engrs. Noted Sept. 25.

Ont., Barrie—Town, 1 mi. 8 in. and up vitr. clay sewers, $25,000. E. Shuter, supt.

Ont., Belleville—For 1¼ mi. 8 in. and up vitr. tile sanitary and storm sewers, $40,000. C. A. Mott, City Hall, engr.

Constr. News page 249

See proposal advertising on page 92

LEADITE

Long Lines and High Pressures—

Above: Part of the "Bee Tree" Line of 24-in. c.i. Bell & Spigot Pipe, laid with LEADITE Joints . . . Wilson-Hewitt Co., Contractors.

VICINITY OF ASHEVILLE

—some c. i. water main installations laid by Wilson-Hewitt Co., Engineers and Contractors, Asheville, N. C.— with LEADITE Joints.

Location	Length of Line	Size	Pressure per Sq. Inch
Bee Tree Gravity Supply Main	11 miles	24″	50 to 300 lbs.
Woodfin Supply Line	11 miles	10″	50 to 400 lbs.
Woodfin Dist. System	23 miles	6″ and 8″	75 to 185 lbs.
South Buncombe System	50 miles	6″-8″-12″	75 to 200 lbs.
Meadows Road Line	2½ miles	12″	200 lbs.
Enka Supply Line	2 miles	18″	150 to 200 lbs (Tested to 350 lbs.)
Enka Village Distribution Line	5 miles	6″	75 to 150 lbs
*French Broad River Line (Temporary)	4.7 miles	12″	260 lbs

* Part of this line was laid through the famous Vanderbilt Estate, and construction was difficult, due to the fact that in passing through this Estate,—no shrubbery, roads or other natural objects were allowed to be disturbed. This, therefore, made the line very crooked.

The following water lines have been constructed by Wilson-Hewitt Co., in towns within a radius of 75 Miles of Ashville, N. C. (Joints made with LEADITE.)

Location	Length of Line	Size of Line	Pressure per Sq. Inch
Mars Hill, N. C.	10 miles	6″	50 to 200 lbs.
Hayesville, N. C.	4.7 miles	6″	75 lbs.
Tryon, N. C.	Approx. 8½ miles	6″-8″	75 lbs.
Old Fort, N. C.	3 miles	8″	50 to 100 lbs.

The Pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%.

THE LEADITE COMPANY
Land Title Building - - - Philadelphia, Pa.

No Caulking

Sewers (Continued)

Ont., Bridgeburg—Town ¼ mi. 36 in. trunk sewer in Niagara Blvd., from Gilmore Rd. to Bridge St. $37,000. Ontario Eng. Co., Queen St., Fort Erie, engrs.

Ont., Fergus — James, Proctor & Redfern, engrs., 1004 Excelsior Life Bldg., Toronto, making surveys, reports for sewerage system for City. $100,000. Noted Oct. 23.

Ont., Hamilton—W. L. McFaul, city engr., soon takes bids sewers in Vansittart Ave., Birmingham, Picton and Concession Sts. $261,000. Noted Dec. 11.

Ont., Hamilton—Soon takes bids 1 mi. 8 in. and up vitr. clay sewers in Claremont Dr. and Prince George Ave. $43,313. W. L. McFaul, engr.

Ont., Hespeler — Council sewerage system, $40,000. H. Johnson, 130 Lancaster St. E., Kitchener, engr.

Ont., Pembroke—Town, ¾ mi. 8 in. vitr. clay sewers. $25,000. J. P. Howe, engr. Work may be done by day labor.

Ont., Toronto—East York Twp., 1 mi. 8 in. and up vitr. clay storm and sanitary sewer in Heath St. and Burnham Rd. $30,756. G. R. Jack, 443 Sammon Ave., engr.

BIDS ASKED

La., New Orleans—Feb. 4, by Sewerage & Water Bd., 526 Carondolet St., Contr. 119-D, motors and accessories for vertical trash pump, Drainage Stations 2, 6 and 7; Contr. 210-S, cal trash pumps, c.i. pipe and fittings, and Contr. 209-S, valves for vertical trash pumps, Drainage Stations 2, 6 and 7; Contr. 210-S, alterations to Drainage Stations 2 and 6. G. G. Earl, genl. supt.

Mass., Saugus—See "Contracts Awarded."

N. J., East Orange—Jan. 12, by City Comn., City Hall, storm water drain in William St. between North 13th and North 16th Sts. $25,000. E. Willigerod, city engr.

N. J., Maywood—Dec. 19, by Bd. Boro Council, Boro Hall, 500 gal. 3 hp. 860 R.P.M., vertical sewage pump, connected to electric motor, incl. suction discharge piping, appurtenances. $7,500. McClave & McClave, 600 Gorge Rd., Cliffside, engrs.

N. Y., Attica—Jan. 13, by Dpt. Correction, State Office Bldg., Albany, sewers and water lines, at Attica State Prison, Wyoming Co. W. N. Thayer, Jr., comr.; adv. E. N.-R. Dec. 18.

N. Y., Long Island City—Dec. 22, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewers in Farmers Blvd., 82nd St., 43rd, 54th, Glenmore, 112th, Ascan and Metropolitan Aves.; sanitary sewers in 184th and Fern Place, 185th and 175th Sts., Hempstead Ave., Springfield Blvd., Rex Rd.

N. Y., Marcy — Dec. 30, at office Dpt. Mental Hygiene, F. W. Parsons, comr., State Office Bldg., Albany, sewers, water lines at Utica State Hospital, Marcy Div., Oneida Co.; adv. E. N.-R. Dec. 18.

N. Y., New York—Dec. 30, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., furnishing, installing drainage equipment for Line A from Fulton to 207th St., incl. 207th Street Yard, of Independent System of City-Owned Rapid Transit Railroads.

O., Medina—Dec. 20, by Village, 1,100 cu.yd. excav., 4,000 ft. vitr. pipe. G. B. Gascoigne, Leader Bldg., Cleveland, engr.

Pa., Oil City—Dec. 22, by B. B. Weber, city engr., storm and sanitary sewers in Plummer Alley, Maple Ave., Plummer and Wood Sts.

Ont., Hamilton—Dec. 24, by S. H. Kent, city clk., City Hall, 4,651 lin.ft. concrete trunk sewer in Dundurn Ave., Main Poulette, Hunter, Locke Sts.; 2,616 lin.ft. Hunter, Queen, Bold and Hess Sts.; 2,437 lin.ft. Robinson St. $300,000. W. L. McFaul, city engr.

Ont., Hamilton—See "Contracts Awarded."

Ont., Sault Ste. Marie — See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Los Angeles—Los Angeles Co., 8 and 10 in. vitr. sewers in Graham Unit 4, Baird Ave., to Kustovich & Wold, 1919 Wedgewood Ave., Temple City, $107,825. Noted Nov. 13.

Md., Towson—Baltimore Co., Court House, vitr. sewers, Contr. 22-S, to P. Marocco, 231 South Exeter St., Baltimore, $67,621. Noted Nov. 27.

Mass., Saugus—Town, Bd. Selectmen, sewerage and drain improvement, day labor, $31,000. Noted Dec. 11.

Minn., Windom — M. Peterson, city clk., sewers, to H. T. Gerischer, 1228 Dayton Ave., St. Paul, $10,652; paving 19,678 sq.yd., to Booth & Olson, Sioux City, Ia., $44,784. Noted Nov. 20.

Mo., Kansas City—Sanitary sewers in Dists. 570, 572, 595, 594 in Div. 6, to McGraw Constr. Co., 220 Bway., $121,420.

N. Y., Hudson—Comn. P. Wks., City Hall, sewers, appurtenances, to H. Dumary, 30 Ontario St., Albany, (a) $65,000; to Thompson Constr. Co., Hudson, (b) $19,000. Noted Nov. 6.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewers in Rockaway Blvd., to Logran Contg. Co., 2301 Beverly Rd., Brooklyn, $26,112. Noted Nov. 20.

Tex., Fort Worth—City, c/o O. E. Carr, mgr., sanitary sewer in Fournier St., to F. Parrott, 1st Natl. Bank Bldg., Dallas, $31,773. Noted Nov. 13.

Ont., Fort Erie—For 36 in. trunk sewer in Niagara Blvd., to Carroll Sharp Co., 43 Scott St., $35,000.

Ont., Hamilton—Storm relief sewerage system, in West Hamilton, day labor under supervision W. L. McFaul, city engr. $500,000.

Ont., Port Arthur—For 3 mi. 8 in. and up vitr. clay storm and sanitary sewers, day labor, $100,000. J. A. Antonisen, city engr. Noted Dec. 11.

Ont., Sault Ste. Marie—Storm sewers, $60,000 and filling in Fort Creek, $42,000, day labor. A. H. Russell, city engr.

Ont., Trenton—Town, 1¼ to 2 mi. 8 in. and up vitr. tile sewers, day labor, $25,000. W. J. Perks, Trenton, engr.

WASTE DISPOSAL

PROPOSED WORK

Mass., Worcester—City, Mayor's Office, City Hall, preliminary plans incinerator, $260,000. Metcalf & Eddy, 1300 Statler Bldg., Boston, archts.

Ont., Hamilton—Soon takes bids 2 incinerators, 140 x 180 ft., brick, concrete, 1 in eastern section and other in western section city, $300,000. W. L. McFaul, City Hall, engr. Noted July 17.

Ont., Sandwich — Town, concrete, brick, garbage incinerator, with incinerating equipment, on Yawkey property, $35,000. C. R. McCall, 56 Pitt St., Windsor, engr.

BRIDGES

PROPOSED WORK

Calif., San Francisco—Golden Gate Bridge & Hy. Dist., 690-A Market St., bids in February, toll bridge over Golden Gate Strait, connecting city with Marin Co. $35,000,000. Strauss Eng. Co., 609-A Market St. and DeYoung Blvd., San Francisco, Calif., and 307 North Michigan Ave., Chicago, Ill., engrs. Noted Nov. 27.

Calif., Stockton—San Joaquin Co., 302 ft. draw span bridge with 258 ft. swing span, 24 ft. roadway. J. Manthey, Stockton, co. surv.

Ill., Chicago—Lincoln Park Comrs., Clark and Center Sts., L. M. Thomas, secy., soon takes bids Lincoln Park Outer Drive Bridge, 350 ft. double leaf trunnion bascule type, 108 ft. wide, with two 38 ft. roadways, sidewalks, near mouth of Chicago River, $10,000,000. H. E. Young, 208 West Washington St., engr., Strauss Eng. Co., 307 North Michigan Ave., designed bridge.

Ia., Muscatine—See "Excavation, Drainage, Irrigation, Levees, River and Harbor," under "Contracts Awarded."

Mo., St. Louis—Bd. P. Serv., City Hall, preliminary plans rein.-con., steel viaduct over St. Louis-San Francisco R.R. and River Des Peres between McCausland and Fyler Aves. $500,000. L. R. Bowen, city engr.

Mo., St. Louis — City and Missouri Pacific R.R. Co., E. A. Hadley, ch. engr., Missouri Pacific Bldg., and Terminal R.R. Assn. of St. Louis, H. J. Pfeiffer, ch. engr., Union Sta., bids early in 1931, repairing 21st St. viaduct over Mill Creek Valley, $50,000.

Okla., Verdigris—State Hy. Dpt., Oklahoma City, 1 span 188 ft., steel truss bridge over Verdigris River, Rogers Co. $175,000. A. R. Losh, hy. engr.

Wash., Seattle — Permanent concrete bridge, on Emerson St. $200,000. R. H. Thomson, city engr.

Ont., Becher—Lambton Co. (Sarnia) J. McCallum, County Bldgs., Sarnia, engr., soon takes bids 200 ft. steel, concrete bridge over Sydenham River. Noted July 31.

Ont., Owen Sound — City Council, 100 ft. rein.-con. bridge, 9th St. $35,000. R. C. McKnight, City Hall, engr.

BIDS ASKED

Alabama—Jan. 6, by State Hy. Dpt., Montgomery, Bridge 496, 136 ft. 6 in. timber, steel, concrete—steel truss, I-beam span bridge over Warrior River—rein.-con. structural steel grade separation, Federal Aid Project 214, Jefferson Co. W. Finnell, hy. dir.

Calif., Santa Rosa — Dec. 23, by Bd. Directors Joint Hy. Dist. 16, Sonoma Co., 900 ft. bridge, incl. two 145 ft. steel deck truss spans, nine 60 ft. steel girder spans, with concrete deck, steel beams, piling, one 30 ft. and one 40 ft. rein.-con. abutments over Russian River, near Jenner. J. N. Piatt, Daugherty-Shea Bldg., engr. Noted Oct. 13.

Florida — Jan. 12, by State Roads Dpt., Tallahassee, 461 ft. bridge to have one 160 ft. steel span on concrete piers and nine 30 ft. rein.-con. deck girder approach spans on precast concrete or concrete piers, earth approach fills and surface on same, Federal Aid Project 67, Road 50, Suwannee and Hamilton Counties. B. M. Duncan, state hy. engr.

Ia., Independence—Dec. 29, at office Auditor Buchanan Co., 80 x 20 ft. pony truss bridge and one 40 x 24 ft. I-beam bridge, both with concrete floor and abutments.

Kan., Paola—See "Contracts Awarded."

Maryland—Dec. 30, by State Roads Comn., Baltimore, superstructure structural steel girder bridge over Pennsylvania R.R., at Bare Hills, Contr. B-175-43, Baltimore Co. G. C. Uhl, chn., Baltimore; adv. E. N.-R. Dec. 18.

Mass., Newton—Dec. 22, by Water Comrs., City Hall, water supply alterations, incl. building and surface drains, $15,000 or more. C. S. J. White, 625 Beacon St., engr. Noted Dec. 4.

Miss., Ovett—Jan. 7, by Bd. Supervs. Jones Co., Ellisville, driving pile, fitting caps, new foundation, moving old steel span in construction new bridge over Bogue Homa Creek on Moselle-Ovett Rd., near here. J. L. Wheless, Hattiesburg, engr.

Miss., Scobey — Jan. 5, by Bd. Supervs. Tallahatchie Co., Charleston, one span 60 ft., one 80 ft. span steel bridges, Beat 3.

South Carolina—Dec. 30, by State Hy. Comn., Columbia, bridges in Union, Greenville, Anderson, Oconee, Laurens, Charleston, Pickens, Hampton and Abbeville Counties. $300,000.

Tex., Houston—Jan. 7, at office City Secretary, rein.-con. bridge over Brays Bayou. Telephone Rd. Noted Dec. 4.

CONTRACTS AWARDED

Calif., Pulga—State Hy. Comn., Sacramento, substructure for bridge over North Fork Feather River, Butte Co., to R. B. McKenzie, Red Bluff, $32,370. Noted Nov. 6.

Kan., Paola—Miami Co., Creamery Bridge, one 140 ft. and two 80 ft. marsh spans, to Maxwell Constr. Co., Columbus, $36,088; Walnut Creek Bridge, two 35 ft. deck girder spans, and Coughlin Bridge, two 40 ft. deck girder spans, to J. Kaufman, Gridley, $5,941 and $4,759 respectively. Grand total $46,788. Packard Bridge, three 16 ft. slab spans, will be built by day labor. Noted Oct. 1

Me., Boothbay — State Hy. Dpt., Augusta, Knickerbocker Bridge, concrete, steel, to Badger Rand Ice Co., 1 Cate St., Portsmouth, N. H., $43,840. Noted Nov. 27.

Maryland — State Roads Comn., Baltimore, superstructure, concrete floor, approaches for proposed grade elimination over Pennsylvania R.R., Contr. AA-75-73, Anne Arundel Co., to Jarboe & Haughton, Mechanicsville, $44,855. Noted Aug. 28.

Maryland — State Roads Comn., Baltimore, structural steel girder superstructure for bridge over Pennsylvania R.R., Contr. AA-101-73, Anne Arundel Co., to Phoenix Bridge Co., Phoenixville, Pa., $7,357; extending triple span concrete bridge, Contr. M-162-511, Montgomery Co., to M. J. Grove Lime Co., Lime Kiln, $9,103.

Minnesota—State Hy. Dpt., St. Paul, Bridge 3954, at Hokah, Houston Co., to Feller Bros., Rochester, $22,674; Bridges 5029, 5030 and 5034, south of Big Falls, Koochiching Co., to Minneapolis Bridge Co., 701 Metropolitan Life Bldg., Minneapolis, $30,668. Noted Dec. 4.

Missouri—State Hy. Dpt., Jefferson City, to H. Tidd, Hutchinson, Kan., bridges in Adair Co., $6,554; over North River Sta. 70-25, $3,515; over North River, Sta. 1211-23, $4,703, both Knox Co.; Lewis Co., $9,669; over Allen Branch, Scotland Co. $5,135; over Bear Creek, Scotland Co. $3,240; over Soap Creek $2,020, over Willow Branch $2,915, over Slough, $1,903 all foregoing in Mercer Co.—to Bunnell & Mack Constr. Co., Paragould, Ark., over Branch $991; over Pine Branch $3,294; over Pine Brook $2,147, all foregoing Washington Co.—to A. E. Keith Constr. Co., 614 City Bank Bldg., Kansas City, over East Tabo Creek, $6,276; over Jim Creek, $2,994, both Henry Co.—to McNerney & Newton, Carthage, over Cedar Creek, Cedar Co. $19,305; over Kings Creek, McDonald Co., $5,242—to R. E. Martin, Cotton States Bldg., Nashville, Tenn., over West Huzzah Creek, $5,005; over Barney Creek $6,615; over Spring Creek $8,951; over Spring Branch $3,999, all Dent Co.—to Chaney & Amyx, Branson, over Branch, Wright Co. $880; over Evening Shade Creek, Wright Co. $4,175—to L. W. Hayes, Constr. Co., Bethany, over Curve River, $14,141; over Branch $946, both Pike Co.—to F. W. Whitehead, Kahoka, over branch, Clark Co. $983; over South Wyaconda River D. D., Clark Co. $11,043 — to Davis Constr. Co., Inc., Boonville, over Silt House Branch, Gasconade Co. $4,268; over Iona Branch, Lincoln Co. $1,908—to F. T. O'Dell, Hannibal, over Mill Creek, Lincoln Co. $4,926—to Wyland & Yard, Boonville, over Big Locust Creek, Sullivan Co. $27,004—to Richmond Constr. Co., Advance, west of Lutesville, Bollinger Co. $4,273—to Stephans & Orender, California, over Clarks Fork Creek, Cooper Co. $7,596—to Lahar Constr. Co., Boonville, over Turkey Creek, Dunklin Co. $3,248—to Service Constr. Co., Poplar Bluff, at Arcadia, Iron Co., $21,985. Grand total $211,849. Rejected bid bridge over Big Shannon Creek, Shannon Co. Noted Nov. 27.

New York—Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, stone faced structural steel, protection for Catskill Aqueduct and 3 store, timber bridge rein.-con. on Saw Mill River Parkway, Mount Pleasant and New Castle, to B. and D. Lundholm, Pittsfield, Mass., $45,300. Noted Nov. 20.

N. Y., Brooklyn—Park Bd., W. R. Herrick, pres. Park Bd., Arsenal Bldg., Central Park, New York, reconstructing Breeze Hill Bridge, to F. A. Regan Constr. Co., 1008 4th St., $11,640. Noted Nov. 20 under "Sports and Parks."

N. Y., New York—A. Goldman, comr. Plant & Structures, Municipal Bldg., reconstructing underfloor and roadway Bronx River approach to Macombs Dam Bridge over Harlem River, to Eastern Constr. Co., 110 West 40th St., $129,600. Noted Nov. 27.

Ont., Breslau — Dpt. P. Hys., Parliament Bldgs., Toronto, 500 ft. rein.-con. beam bridge, to Dufferin Paving & Crushed Stone Co., foot or Bathurst St., Toronto, est. $80,000.

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STREETS AND ROADS

BIDS ASKED

Alabama—Jan. 6, by State Hy. Comn., Montgomery, 7 in. concrete paving 263 mi. hys. in Walker, Marion, Madison, Limestone, Etowah, Jefferson, Escambia, Baldwin, Cullman, Houston, Calhoun, Montgomery, Sumter, Dallas and Colbert Counties. $4,679,000. W. Finnell, hy. dir.

Ala., Birmingham—Jan. 20, by City Comn., 7 in. concrete paving 100 lin.ft. 17th St. S., 8875 — grading, concrete curbing, guttering, sidewalks, 7 in. concrete paving 4 blocks Georgia Rd., $19,150, both 30 ft. wide—16 blocks same road, 30 ft., 37 and 26 ft., $81,000. A. J. Hawkins, city engr.

Arizona — Dec. 22, by State Hy. Comn., Phoenix, grading, constructing concrete ford 1.3 mi. Phoenix-Yuma Hy., Maricopa Co.—grading, bridging 5 mi. Globe Safford Rd.—5.3 mi. Safford-State Line Rd., both Graham Co. W. W. Lane, state hy. engr.

Arizona — Dec. 29, by State Hy. Comn., Phoenix, placing subgrade stabilizer on 9.3 mi. Ashfork-Seligman Hy., and oil processing 30.5 mi. Globe-Safford Rd. W. W. Lane, state hy. engr.

California — Dec. 30, by State Hy. Comn., Sacramento, grading, bituminous macadam surfacing, 3 mi. road between Hart Station and point 3 mi. east, Kern Co. C. H. Purcell, hy. engr.

Calif., Long Beach—Dec. 23, by City Council, sidewalks, curbing, guttering, gas and water service pipes, storm drains, concrete paving 155,000 sq.ft. Santa Fe Ave. between Livingston Dr. and 7th St.

Calif., Newport Beach—Jan. 5, by City Council, 4 in. concrete paving 140,000 sq.ft., waterworks, 6 and 8 in. vitr. sewers in River Ave.

Calif., Oakland — Dec. 24, by City Council, F. C. Merritt, city clk., grading, vitr. pipe conduits, concrete paving 155,000 sq.ft. East 10th St. To exceed $50,000.

Idaho—Dec. 22, by J. D. Wood, comr. P. Wks., Boise, grading 7.668 mi. Old Oregon Trail, Southern Branch, between Parma and Fruitland, Canyon and Payette Counties; graveling 7.228 mi. Old Oregon Trail, Southern Branch, between Caldwell and Notus, Canyon Co.

Ind., Boonville—Jan. 5, by Bd. Comrs. Warrick Co., concrete surfacing Philip Hoffman Rd. $64,000. E. Bracher, Boonville, aud.

Ind., Evansville — Dec. 22, by Bd. Comrs. Vanderburgh Co., gravel surfacing St. Joseph Avenue Rd. $39,920. S. B. Bell, Evansville, aud.

Ind., Warsaw—Dec. 27, by Kosciusko Co., gravel surfacing 2.7 mi. Kary E. Day Rd. $15,481—concrete surfacing 4.63 mi. Jesse B. Marion Rd. $90,892—3.19 mi. Oder Arnold Rd. $72,608. H. B. Helvey, Warsaw, aud.

Louisiana—Jan. 6, by State Hy. Comn., Baton Rouge, surface treating 12 mi. Farmerville-Marion Hy., Union Parish; 20 mi. DeRidder-Texas Line Rd., Beauregard Parish. W. H. Norckauer, hy. engr.

Louisiana — Jan. 6, by State Hy. Comn., Baton Rouge, grading, drainage structures 11.4 Grayson-Rosefield Hy., Caldwell and La Salle Parishes—2.4 mi. Gibson-Lake Bridge Rd., Terribone and Assumption Parishes—8.2 mi. Jonesboro-Midway Church Rd., Jackson and Winn Parishes—3.7 mi. Hope-Hill Creek Rd., Bienville Parish—3 mi. Houma-Raceland Cutoff, Lafourche Parish— 16.4 mi. LeBeau-Krotz Springs Rd., St. Landry Parish—8.3 mi. Bayou Des Allemands-Butte Rd., St. Charles Parish—2.6 mi. Gibson-Donner Hy., Terribone Parish—sub-grade treatment 16.8 mi. Sorrento-Gramercy Rd., on Baton Rouge-New Orleans Hy., Ascension and St. James Parishes—grading, shell or gravel surfacing 10.5 mi. Reeves-Dry Creek Rd., Allen and Beauregard Parishes—4.8 mi. Archie-Marksville Rd., Rapides Parish — 3.2 mi. Anacoco-Kurthwood Hy., Vernon Parish—concrete surfacing 11 mi. St. Martinville-New Iberia Hy., St. Martin and Iberia Parishes—17 mi. Jonesboro-Tannehill Rd., Winn and Jackson Parishes—12 mi. Marksville-Rapides Parish Rd., Avoyelles Parish—8.7 mi. north and south hy. through Farmville and west 4 mi., Union Parish. W. H. Norckauer, hy. engr.; adv. E. N.-R. Dec. 18.

Massachusetts — Dec. 23, by Dpt. P. Wks., State House, Boston, A. W. Dean, engr., rein.-con., bituminous macadam (dual type), paving 31,565 ft. hy. Marlboro and Northboro—bituminous macadam paving 13,921 ft. hy. Southbridge and Sturbridge—11,770 ft. Weston—rein.-con. paving 34,400 ft. Foxboro, Wrentham, Plainville and North Attleboro.

Mass., Hull — Dpt. P. Wks., State House, Boston, bids about Dec. 27, constructing 4 mi. road, Nantasket Beach Reservation. $450,000. A. W. Dean, Dpt. P. Wks., Boston, engr.

Michigan—Dec. 23, by E. D. Crandall, resident engr., Cadillac, grading, shaping, drainage, gravel surfacing 7.799 mi. FO83-13-Contr. 1, 21 ft., Wexford Co., for State Hy. Comn., Lansing.

Nebraska—Dec. 29, by State Dpt. P. Wks., at Court House, Columbus, graveling in Antelope and Holt Counties—grading, culverts in Holt Co.—overhead crossing in Platte Co. R. L. Cochran, Lincoln, state hy. engr.

Nebraska—Dec. 30, Dpt. P. Wks., Lincoln, concrete paving bridges in Lancaster and Sarpy Counties. R. L. Cochran, state hy. engr.

New Hampshire—Dec. 23, by State Hy. Dpt., Concord, bituminous macadam paving 2.85 mi. hy. Pinkham Notch.

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N. J., Bayonne—Jan. 12, at office General Manager Port of New York Authority, 80-90 8th Ave., New York, constructing Bayonne Approach, 3rd to 7th Sts., to Kill van Kull Bridge, between Bayonne, N. J. and Port Richmond, N. Y. J. F. Galvin, chn.; adv. E. N.-R. Dec. 18.

N. J., Cliffside Park—Dec. 22, by Bd. Boro Council, Boro Hall, grading, sheet asphalt on concrete paving Riverview Ave. $44,500. McClave & McClave, 600 Gorge Rd., boro engrs.

N. Y., New Rochelle—Dec. 22, by C. MacDonald, engr. Westchester Co., Court House, White Plains, improving 1.19 mi. North Ave., Co. Rd. 81; adv. E. N.-R. Dec. 18.

N. Y., New York — Dec. 22, by J. Miller, pres. Manhattan Boro, Municipal Bldg., granite block on concrete repaving William St.—widening, sheet asphalt on concrete paving West 144th St.—installing 12 ft. radius at 165th St. and Bway, and at 137, other intersections—altering, improving 20th St. outlet sewer, constructing storm overflow in 11th Ave. adjacent to Pier 61, North River.

N. Y., New York—H. Bruckner, pres., Bronx Boro, Crotona Park, 3rd and Tremont Aves., rejected bids Dec. 2, regulating Goulden Ave. Noted Nov. 27.

N. Y., New York—Dec. 23, by H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., curbing, sidewalks, Tibbett Ave.—grading Waterbury and Goulden Aves.—sewers in Jerome Ave.—receiving basins in Adams Pl., East 183rd St., and Riverdale Ave.

N. Y., St. George—Dec. 24, by J. A. Lynch pres. Richmond Boro, Boro Hall, furnishing, placing cinders on roadway Vernon Ave. from railroad to Detroit Ave.

O., Cincinnati—Dec. 23, by C. A. Dykstra, city mgr., stone curbing, cement sidewalks, concrete paving 4,800 sq.yd. Mill St. from 2nd to 5th Sts. $25,000.

Pa., Pittsburgh—Dec. 19, by E. G. Lang, c/o Dpt. P. Wks., City-County Bldg., grading, curbing, paving St. Agatha Way, Guthrie, Sanders, Trevanion and Kenilworth Sts., $43,500; Independence St. from Woodville to city line $160,000. C. M. Reppert, City-County Bldg., engr.

South Carolina—Dec. 30, by State Hy. Comn., Columbia, concrete paving 193.376 mi. hys. in Marion, Dillon, Darlington, Bamberg, Greenville, Dorchester, Orangeburg, Lexington, Lee, Colleton, Sumter, Edgefield, Greenwood, Laurens, Marlboro Counties; grading 3.8 mi. Marion and Horry Counties. $5,000,000.

Texas—Dec. 20, by G. Gilchrist, state hy. engr. Austin, grading, drainage structures, concrete paving and concrete pavement approaches to Bear Creek Bridge, 6.11 mi. Hy. 121, 22 ft., $150,000; 0.844 mi. Hy. 34, Tarrant Co., 44 ft. $54,000.

Utah, Salt Lake City — Dec. 29, by Comrs. Salt Lake Co., concrete paving 1.8 mi. 9th St. E. from 33rd St. to 48th St.-S. J. Blickensderfer, Salt Lake City, co. surv.

Wash., Port Orchard — Jan. 5, by Comrs. Kitsap Co., grading, graveling 5.3 mi. Manette-Brownsville Rd. J. L. Berry, Port Orchard, engr.

Wash., Seattle—Bids early in 1931, grading, paving Sand Point Way. $157,000. R. H. Thomson, Seattle, engr.

Ont., Trenton—See "Contracts Awarded."

CONTRACTS AWARDED

California — State Hy. Comn., Sacramento, bituminous macadam surfacing 10.7 mi. road between San Felipe and point 1 mi. east Bells Station, Santa Clara Co., to Contoules Constr. Co., 46 Collins St., San Francisco, $212,285.

Calif., Fresno—Fresno Co., permanite asphalt concrete paving Mt. Whitney Ave., to Valley Paving & Constr. Co., Visalia, $33,820.

Calif., Los Angeles—Bd. P. Wks., City Hall, storm drains, grading, 8 in. concrete paving 235,000 sq.ft. West Blvd., to Tryon & Brain, 416 California Bldg., $80,285.

Florida—State Road Dpt., Tallahassee, broken stone base paving 23.69 mi. Projects 806C and D. Rd. 25, Hendry Co., to L. B. McLeod Constr. Co., Williston, $284,213. Noted Dec. 4.

Ind., Columbia — Bd. Comrs., Whitley Co., gravel surfacing 29,821 ft. Smith and Watson Rds., to A. Rosenberry, Butler, $26,680 est. $47,407; 15,136 ft. Gross Rd., to Betts & Essinger, Columbia City, $9,944 est. $16,385. Noted Nov. 27.

Ind., Crown Point—Lake Co., gravel surfacing 2 mi. Frank DeLau Rd., to W. Prohl, Hammond, $18,922. Est. $25,000. Noted Nov. 20.

Ind., Laporte—Laporte Co., concrete surfacing 2.21 mi. Fred Warnke Rd., to E. W. David Constr. Co., Michigan City, $61,173. Est. $69,505. Noted Nov. 20.

Ind., Washington—Daviess Co., crushed limestone surfacing A. B. Clark Rd., to Martindale Constr. Co., Washington, $26,890 est. $36,934; Edith By, Ray Rd., to Blockwood & Shake, Sandborn, $13,480 est. $17,114. Noted Nov. 20.

Kansas—State Hy. Comn., Topeka, grading 1.455 mi. bridge approaches in Clay Co., to Rogers Constr. Co., Salina, $18,852 — sand gravel surfacing 14 mi. Jewell Co. and 7 mi. Cloud Co., to Koehler Constr. Co., Sterling, Neb., $13,888 and $6,944 respectively—1.75 mi. Lincoln Co., to M. W. Watson, Topeka, $1,939—16.85 mi. Clay Co., to Reed & Wheelock, Clay Center, $12,806. Grand total $54,429. Noted Nov. 27.

Kansas—State Hy. Comn., Topeka, at Court House, Sedan, **(F.A.P. means Federal Aid Project)**, to E. M. Eby, Wellington, regraveling surfacing 15.5 mi. F.A.P. 7216 $3,395; 3 mi. F.A.P. 7217 $1,314; 5 mi. F.A.P. 7218 $2,190 all Waubansee Co.; 9 mi. Osage Co. $4,122; 10 mi. F.A.P. 7248 $4,120; 14.7 mi. F.A.P. 7247 $5,557; 4.5 mi. F.A.P. 7254 $1,885, all Woodson Co.—to McMillen & Furman, Emporia, 3 mi. Lyons Co. $1,752—to San-Ore Constr. Co., McPherson, 6 mi. Rush Co. $5,280—to Cook & Cone, Ottawa, 12.25 mi. F.A.P. 7246 $6,652; 4.5 mi. F.A.P. 7250 $2,268; 8 mi. F.A.P. 7251 $3,936, all Franklin Co.; 2.25 mi. F.A.P. 7252 $399; 2 mi. F.A.P. 7255 $784, both Allen Co. 3 mi. Wilson Co. $540—to Western Bridge & Constr. Co., Omaha Natl. Bank Bldg., Omaha, Neb., 7.7 mi. Labette Co. $2,695—to Keehler Constr. Co., Sterling, Neb., 8 mi. Woodson Co. $3,040—to Campbell Bros., 608 Manufacturers Exch. Bldg., Kansas City, Mo., grading 1.002 mi. Chautauqua Co. $4,726; 3.026 mi. Cowley Co. $31,422—to Tomlinson Bridge & Supply Co., Garfield, bridge in Cowley Co. $10,354. Grand total $95,831.

Kansas—State Hy. Comn., Topeka **(F.A.P. means Federal Aid Project)**, to Putnam Sand Co., Salina, regravel surfacing 14.3 mi. roads in Saline Co. $6,435—to W. D. Shay, McPherson, 10 mi. Rice Co. $3,200; 6.2 mi. Chase Co. $3,038—to E. M. Eby, Wellington, 7.5 mi. McKenzie Co. $3,525; 8.6 mi. F.A.P. 7192 $1,788; 12.5 mi. F.A.P. 7193, $2,804, both Clay Co.—to Roberts Constr. Co., Wichita, 11 mi. F.A.P. 7138 $2,574; 9 mi. F.A.P. 7245 $2,304, both Sedgwick Co.; 11.8 mi. F.A.P. 7210 $2,572; 3.3 mi. F.A.P. 7209 $753, both Marion Co.—to Thogmartin & Reis, Ft. Scott, 12 mi. Sumner Co., $3,576—to D. H. Hardman, 11 mi. Pawnee Co. $3,388; 8.5 mi. F.A.P. 7239 $3,638; 3 mi. F.A.P. 7147 $1,284, both Rush Co.—to M. W. Watson, Topeka, 4.5 mi. P.7234 $1,692; 12 mi. F.A.P. 7236 $5,736, both Kiowa Co.—to H. L. Wilcox, Anthony, 8 mi. F.A.P. 7241 $2,720; 4 mi. F.A.P. 7143 $1,440, both Harper Co.—to Cook & Cone, Ottawa, 11.5 mi. F.A.P. 7242 $4,830; 6 mi. F.A.P. 7243 $2,520, both Cowley Co.; 5.3 mi. P.7179 $2,459; 2.088 mi. F.A.P. 7178 $2,088; 14.5 mi. F.A.P. 7180 $3,770; 7.5 mi. F.A.P. 7181 $3,480, all Marion Co.—to Western Bridge & Constr. Co., 3807 Leavenworth St., Omaha, Neb., 2.5 mi. Barber Co. $1,195—to C. Hume, Great Bend, 7 mi. F.A.P. 7237 $2,576; 11.5 mi. F.A.P. 7242 $4,830, both Barton Co.; 2 mi. Edwards Co. $920; 2.5 mi. Stafford Co. $1,150—to L. Black, Vesper, 8 mi. Lincoln Co. $2,640. Grand total $84,925.

Kansas — State Hy. Comn., Topeka **F.A.P. means Federal Aid Project)** to D. Scherrer, 329 North 18th St., Kansas City, grading, drainage structures 3.945 mi. roads in Jackson Co. $32,121—to Gray & Harbut, Emporia, 1 mi. Lyons Co. $24,236; 2 bridges $25,314 — to Kohler Constr. Co., Sterling, Neb., regravel surfacing 5 mi. Jackson Co. $6,090; 11 mi. F.A.P. 1115 $6,512; 8.5 mi. F.A.P. 1092 $5,610, 6.2 mi. F.A.P. 7225 $1,426, all Marshall Co.—to Roberts Constr. Co., Wichita, 4.4 mi. Marion Co. $928; gravel surfacing 10 mi. Marshall Co. $8,520; concrete surfacing 3.996 mi. Brown Co. $104,199—to B. Metzger, Ozawkie, re-gravel surfacing 4 mi. F.A.P. 1114, $3,480; 7 mi. F.A.P. 1113 $7,350, both Johnson Co.; 2.5 mi. F.A.P. 7229 $1,315; 2 mi. F.A.P. 7230 $789; 1.4 mi. F.A.P. 7231 $840, all Jefferson Co.—to City Sand Co., Manhattan, 3.5 mi. Riley Co. $961—to Cook & Cone, Ottawa 8 mi. Riley Co. $4,448; 6 mi. Marshall Co. $2,532—to Western Bridge & Constr. Co., 3807 Leavenworth St., Omaha, Neb., 12.121 mi. Atchison Co. $18,220 — to W. W. Watson, Topeka, 16 mi. Riley Co. $2,412; channel excavation, Leavenworth Co. $1,800. Grand total $260,003.

Kan., Kansas City—Rock asphalt paving 43rd St. from state line to Mission Rd., to Dan Scherrer Constr. Co., Barker Bldg., $74,431.

Kan., Ottawa—Franklin Co., sand gravel or chats surfacing 4 mi. roads, to A. L. Cook, Ottawa, $28,574.

Kentucky—State Hy. Dpt., Frankfort, grading, drainage structures 5.364 mi. roads in Green Co., to Patterson Constr. Co., Heidrick, using 1st class rein.-con. pipe $31,001; 13.217 mi. Bullitt Co., to Carter, Carter & Braden, Clay, using 1st class rein.-con. pipe $49,220. Noted Dec. 4.

Louisiana — State Hy. Comn., Baton Rouge, gravel surfacing 8.3 mi. Columbia-Chatham Hy., Caldwell Parish, to J. W. McKeithen, Grayson, $88,236.

Massachusetts—Dpt. P. Wks., Boston, bituminous macadam paving 19,967 ft. hy. Chester, to Fitchburg Constr. Co., 44 Henry St., Fitchburg, $251,877 — bitulithic concrete paving 13,516 ft. hy. Chilmark and West Tisbury, to M. F. Roach & Sons, 55 Spring St., East Bridgewater, $50,183 — 29,800 ft. Barnstable, to Lane Constr. Corp., 134 State St., Meriden, Conn., $190,823—15,567 ft. Bourne and Plymouth, to A. D. Bridges Sons, Inc., Hazardville, Conn., $98,553—rein.-con. paving 9,060 ft. and bituminous macadam paving 5,090 ft. Sheffield, to New Haven Constr. Co., Dixwell Ave., New Haven, Conn., $88,733. Grand total $680,169. Noted Nov. 27 and Dec. 4.

Michigan—R. W. Roberts, resident engr., 504 Eddy Bldg., Saginaw, grading, shaping, drainage, concrete paving 6.953 mi. FO90-20-Contr. 1, Bay Co., to A. Jeffrey, Saginaw, for State Hy. Comn., Lansing, $220,267, incl. cement. Noted Nov. 13.

Streets and Roads (Continued)

Minnesota—State Hy. Dpt., St. Paul, grading, concrete paving 9.9 mi. S.P. 3-46, Sect. 1, F.A.P. 307-C, S.P. 3-43, Div. A, F.A.P. 419, to W. W. Magee, Commercial State Bank Bldg., St. Paul, $139,848—25.3 mi. S.P. 6-31, Sect. 3, S.P. 3-56, F.A.P. 351-C, S.P. 3-32, F.A.P. 351-B, and S.P. 3-40, F.A.P. 351-A, to A. Guthrie & Co., Builders Exch., St. Paul, $522,374—21.4 mi. S.P. 8-26, Sect. 2, F.A.P. 155, to E. W. Coons and R. Maturi, Hibbing, $451,926—18.7 mi. S.P. 8-26, F.A.P. 266, S.P. 8-28, F.A.P. 26, and S.P. 8-33, F.A.P. 270, to Nelson, Mullen & Nelson, 355 Gateway Bank Bldg., Minneapolis, $284,003—11.1 mi. S.P. 15-30, Div. A, F.A.P. 341, to Woodrich Constr. Co., 808 Metropolitan Life Bldg., Minneapolis, $205,037—13.5 mi. S.P. 15-30, Div. B, F.A.P. 341, and SP. 14-27, F.A.P. 74, to Hanlon & Okes, 1501 Merchants Natl. Bank, St. Paul, $224,096—grading 14.6 mi. S.P. 4-49, Sect. 1, F.A.P. 99, and 7.6 mi. S.P. 9-40, Sect. 2, F.A.P. 90, to Lobnitz Bros., Willmar, $81,750 and $49,459 respectively—16.2 mi. S.P. 9-45, Sect. 3, F.A.P. 424-A, S.P. 9-45, Sect. 4, F.A.P. 188, S.P. 9-45, Sect. 5, F.A.P. 38, and 11.4 mi. S.P. 12-27, Sect. 2, F.A.P. 423-A, and S.P. 12-27, Sect. 3, F.A.P. 10-A, to C. Weaver, Anoka, $103,230 and $131,701 respectively—12.2 mi. S.P. 12-27, Sect. 4, F.A.P. 10-B, and S.P. 12-27, Sect. 5, F.A.P. 385-B, to DeRuyter Bros., Willmar, $52,507. Grand total $2,245,931. Noted Dec. 4.

Missouri—State Hy. Dpt., Jefferson City, to Davis Constr. Co., Boonville, grading, concrete paving 3.548 mi. Gasconade Co., $50,963 — 1.276 mi. Lincoln Co., $38,468; 4.34 mi. Gasconade Co., $79,843; 3.721 mi. Gasconade Co., $78,427—to Keely Bros. Constr. Co., East St. Louis, Ill., 0.856 mi. St. Louis Co., $48,472—to M. E. Gillioz, Monett, crushed stone or graveling 3.19 mi. R. S. C. Sect. 1, $20,281; 3.317 mi. Sect. 2, $14,565; 3.157 mi. Sect. 3, $25,131, all foregoing Taney Co.—to Stephens & Orender, California, crushed stone paving 1.619 mi. Sect. 1, R. SD. $6,725; 4.979 mi. Sect. 2, $25,664; 4.848 mi. Sect. 3, $17,769, all foregoing Cooper Co.—to F. W. Hitehead, Kahoka, sand clay surfacing 4.565 mi. Clark Co., $15,479—to H. Tidd, Hutchinson, Kan., shale surfacing 4.506 mi. Adair Co., $21,235; sand clay surfacing 3.054 mi. R. SA, Sect. 1, $9,119; 3.358 mi. Sect. 2, $11,749, both Scotland Co.; graveling 4.84 mi. R. SH, Sect. 1, $11,831; 1.762 mi. R. SN, Sect. 1, $5,783, both Knox Co.; 3.523 mi. R. SD, Sect. 2, $12,902; 2.652 mi. Sect. 1, $9,485, both Lewis Co.; grading 2.606 mi. R. SD, Sect. 1, $8,996; 3.409 mi. Sect. 2, $12,711, both Mercer Co.—to Service Constr. Co., Poplar Bluffs, graveling 0.631 mi. Iron Co., $12,566 — to Garrett Constr. Co., Springfield, 4.795 mi. Dallas Co., $7,520—to W. D. Knoll, Ava, 4.854 mi. Douglas Co., $4,064—to Bunnell & Mack Constr. Co., Paragould, Ark., 4.168 mi. Washington Co., $45,844—to Wyland & Yards, Boonville, 1.973 mi. Sullivan Co., $38,107—to Lahar Constr. Co., Boonville, 3.929 mi. Dunklin Co., $28,062—to R. E. Martin, Cotton States Bldg., Nashville, Tenn., 4.301 mi. R. 32, Sect. 14, $55,077; 2.848 mi. R. 19, Sect. 14, $23,968; 0.66 mi. Sect. 18, $13,792; 0.647 mi. Sect. 20, $4,539, all foregoing in Dent Co.—to L. W. Hayes, Bethany, 4.297 mi. Pike Co., $16,584; 2.102 mi. Pike Co., $11,513—to McNerney & Newton, Carthage, 4.914 mi. McDonald Co., $13,476; 0.405 mi. Cedar Co., $7,555—to F. T. O'Dell, Hannibal, 3.665 mi. R. SC, Sect. 1, $10,990; 3.125 mi. Sect. 2, $9,701, both Putnam Co.; 2.637 mi. R. SE, Sect. 1, $10,449; 2.615 mi. Sect. 2, $12,020, both Lincoln Co.—to Chaney & Amyz, Branson, grading 2.537 mi. Wright Co., $13,659—to A. E. Keith Constr. Co., 614 City Bank Bldg., Kansas City, 3.453 mi. Johnson Co., $12,963; 2.527 mi. Henry Co., $19,238—to Carte-Harlin Constr. Co., West Plains, 3.125 mi. R. SA, Sect. 4, $7,640; 4.812 mi. Sect. 5, $7,747, both Texas Co.—to Ackley Bros., Kansas City, 2.642 mi. R. 40, Sect. 332-B, $16,202; 4.152 mi. Sect. 332-D, $37,483, both Lafayette Co. Grand total $976,357. Rejected bids graveling in Audrain Co. and grading Shannon Co. Noted Nov. 27.

New Jersey—State Hy. Comn., Trenton, grading 9 in. concrete paving 1.876 mi. Bergen and Hudson Counties, to J. Kinsley & Co., Hackensack, $252,465. Noted Nov. 20.

New York—C. MacDonald, engr. Westchester Co., Court House, White Plains, improving Parallel Route of Boston Post Rd., Co. Rd. 67-11, to Malloy Bros., Rye, $185,190. Noted Nov. 20.

New York—Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, grading 4.5 mi. Taconic Parkway connection Bronx Parkway extension from Mohansic Park to Putnam Co. line, to Cook Contg. Co., Scarsdale, $179,393. Noted Oct. 30.

New York—C. MacDonald, engr. Westchester Co., Court House, White Plains, improving Mill Rd., Co. Rd. Rd. 82, Eastchester and New Rochelle, to Paterson & Rossi, 110 Mamaroneck Ave., White Plains, $114,721. Noted Nov. 20.

N. Y., Brooklyn—H. Hesterberg, pres. Brooklyn Boro, Boro Hall, to Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., asphalt paving Battery Ave., $14,123; West 2nd St., $10,946; 11th Ave., $17,844; 62nd St., $5,449; 64th St., $5,376—to Pomonok Asphalt Paving Co., Boerum St., $2,826; Heyward St., $9,528—to M. J. O'Hara, 1228 Park Ave., New York, Avenue H, $4,601—to B. Turecamo, New Cropsey Lane, to West 4th St., $7,369—to Cranford Co., 52 9th St., Lorimer St., $29,136 -to C. S. Crouss, grading Avenue U, $483—to Castle Bros., Johnson Pl. and Snyder Ave., grading East 7th St., $3,991—to Aviron & Son, Inc., 358 Hart St., Ford St., $290; West 7th St., $3,012 — to Concrete Co., Metropolitan Ave., 16th Ave., $1,290. Grand total $116,264. Noted Nov. 27.

N. Y., Harrison—C. MacDonald, engr. Westchester Co., Court House, White Plains, granite curbing, concrete sidewalks, rein.-con. bridge on Halstead Avenue, Co. Rd. 80A, to C. DeLuca, Harrison, $165,752. Noted Nov. 6.

N. Y., New York—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., to C. Turiano Contg. Co., 2913 Coddington Ave., regulating Matthews Ave., $17,749 — to F. Mascali Sons, Inc., 645 East Tremont Ave., Library Ave., $9,509; Kearney Ave., $12,716; West 232nd St. $3,163—to Nabrum, Inc., 2256 Wallace Ave., sewer in Waring Ave., $3,815. Grand total $46,952. Noted Nov. 27.

N. Y., New York—J. Miller, pres. Manhattan Boro, Municipal Bldg., grading, asphalt paving West 66th St. and Madison Ave., to C. D. Beckwith, Inc., Seneca Ave. and Edgewater Rd., $14,431 and $40,229 respectively. Noted Nov. 27.

N. Y., New York—J. Miller, pres. Manhattan Boro, Municipal Bldg., asphalt paving Bway., to C. D. Beckwith, Inc., Seneca Ave. and Edgewater Rd., $23,632. Noted Nov. 20.

N. Y., New York—J. Miller, pres. Manhattan Boro, Municipal Bldg., granite block on concrete paving Jefferson St., to Triboro Asphalt Co., 368 East 148th St., $13,059. Noted Oct. 30.

N. Y., St. George—J. A. Lynch, pres. Richmond Boro, Boro Hall, regulating Gannon Pl., to James Kelly, Inc., 1150 Forest Ave., West New Brighton, $4,702; Alter Ave., to J. J. O'Rourke, 239 Gordon St., Stapleton, $7,048. Noted Nov. 27.

N. Y., White Plains — C. MacDonald, engr. Westchester Co., improving Bway., Co. Rd. 87, to Standard Bitulithic Co., 50 Church St., New York, $390,270. Noted Nov. 20.

North Dakota—State Hy. Comn., Bismarck, to G. Adams & Son, Cooperstown, graveling 17.238 mi. Benson Co. $13,775—to Butler Constr. Co., Grand Forks, 21.296 mi. Logan Co. $21,237; 10.334 mi. Burke Co. $12,422—to N. M. Neilson, Valley City, structural steel on State Route 3, Wells Co. $8,081—to A. J. Jackson, Jamestown, grading 12.656 mi. Stutsman Co. $28,145; 7.052 mi. Eddy Co. $19,343—to A. C. Webster, Turtle Lake, 14.092 mi. Sheridan Co. $32,134; 1.092 mi. Burleigh Co. $23,815—to Win Coman, Goodrich, 9.652 mi. Ward Co. $28,205—to North Dakota Culvert Co., Fargo, corrugated metal pipe culverts in Stutsman Co. $3,040; Eddy Co. $757; Ward Co. $2,680; Burleigh and Sheridan Counties $1,691—to Concrete Sectional Culvert Co., Fargo, concrete pipe culverts in Eddy Co. $1,677—to North Dakota Concrete Products Co., Mandan, in Burleigh and Sheridan Counties $7,678—to Watcher Transfer Co., Bismarck, grading graveling 1.092 mi. Burleigh Co. $6,286. Grand total $210,966.

O., Akron—Comrs. Summit Co., grading, curbing cutting down embankment, straightening curve through the "Gorge," Cuyahoga Falls Rd., to Hollinger-Davidson Co., Akron, $26,388.

O., Cincinnati—City, grading, concrete curbing, guttering, concrete repaving 9,800 sq.yd. Queen City Ave., from Boudinot Ave. to Werk Rd., to De Salvo Constr. Co., 2243 Spring Grove Ave., $40,697 est. $51,531; 10,000 sq.yd. Werk Rd. from Boudidnot Ave. to Glenmore Ave., to A. P. Birnbaum, 3339 Cheviot Ave., $40,443 est. $62,100.

South Carolina — State Hy. Dpt., Columbia, grading, sand-clay surfacing 13.45 mi. hy. Clarendon and Williamsburg Counties, to Beckham-Lawler Constr. Co., Perry, Ga., $97,257—topsoiling 18.07 mi. Kershaw Co., to Smith & Bradfield, Macon, Ga., $168,656—grading, topsoiling 2.97 mi. Saluda and Newberry Counties, and clay macadam surfacing 4.44 mi. Oconee Co., to C. M. Lyle Constr. Co., Gainesville, Ga., $28,764 and $61,223 respectively. Grand total $355,900. Noted Nov. 27.

Tex., Runge—Grading, drainage structures on road between here and Goliad Co. line, to E. P. Edgeworth, Runge, $44,012.

Virginia—State Hy. Dpt., Richmond, grading, drainage structures 5.689 mi. roads in Accomac Co., to DeLuca Constr. Co., Dundalk, Md., $21,165; one course macadam surfacing 1.236 mi. Wythe Co., to R. H. Rolling, Norton, $30,371. Noted Nov. 27.

Washington—S. J. Humes, dir. Hys., Olympia, improving Unit 1, F. A. 169-D, Walla Walla Co., to Union Constr. Co., 618 Bd. of Trade Bldg., Portland, Ore., $61,903. Noted Nov. 13.

Ont., Fort William—Dpt. Northern Development, Parliament Bldgs., Toronto, preparing sub-grade, and 2½ in. consolidated bituminous treated topping 15 mi. International Hy., southerly from here, to J. F. Hewitson, 246 Court St., Port Arthur. Est. $90,000.

Ont., Nipigon—Dpt. Northern Development, Parliament Bldgs., Toronto, grading, 2½ in. bituminous retread paving 11 mi. Nipigon Hy. from end present hy. to Loon Lake, to J. F. Hewitson, 246 Court St., Port Arthur. Est. $65,000.

Ont., Toronto—City Council, concrete paving 4 lanes, to P. Delgreco, 60 Montcalm Ave., $11,652—1 lane, to Certified Concrete Co., 6 Endean Ave., $1,868—bitulithic paving Merton St., to Asphaltic Concrete Constr. Co., Sun Life Bldg., $3,465—asphalt paving Glenforest Rd., to Godson Contg. Co. Ltd., 203 Richmond St. W., $10,909. Grand total $27,984.

Ont., Toronto—City, asphalt paving Cedarvale Ave. and Wellesley St., to Kilmer & Barber, Harbour Bldg., $2,594 and $1,820 respectively—asphaltic concrete paving Blythwood Gardens and Kappelle Ave., to Warren Bituminous Paving Co., 74 University Ave., $15,168—concrete paving 2 lanes to Certified Concrete Co., 6 Endean Ave., $5,114—3 lanes, to L. P. Acri, 28 Grove Ave, $4,352. Grand total, $29,228.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Okla., Oklahoma City—Deep Fork D. D. 14, Oklahoma Co., drainage work. $35,000. R. S. James, 519½ West Main St., engr.

Ont., Gilford — West Gwillinbury Twp., F. Ritchie, clk., Gilford, reclamation 8,000 acre marsh land, incl. excavating, draining, dykes, pumps, $175,000.

Ont., Riverside—Town, filling in West Marsh drain, Riverside Dr. $25,000. G. G. Reid, Town Hall, engr.

Ont., Toronto—City and Dominion Govt., 2 mi. concrete seawall along lake front from Woodbine Ave. to eastern city limits, $1,300,000. E. L. Cousins, Northern Ontario Bldg., engr.

BIDS ASKED

Calif., Placerville — Dec. 30, by R. W. Browne, secy., El Dorado Irrigation Dist., 30 in. c.i. thimbled, 30 in. butterfly valve, complete, two 5 in. air valves complete, needle valve, complete, 795 ft. 30 in. single and double riveted 14 in. plate steel pipe complete with bends and specials in connection with Webber Creek Dam.

Ind., Fowler—Dec. 22, by Bd. Comrs. Benton Co., 11,500 ft. open ditch, 7,215 ft. ditch construction. $25,420. D. Heaton, Fowler, engr.

Ind., Frankfort—Bd. Comrs. Clinton Co. bids about Jan. 10, improving 10 mi. Prairie Creek Ditch, $55,000. N. Amos, Frankfort, engr.

Ia., Clinton—Dec. 22, at office F. Lohberg, aud. Clinton Co., excavating 160,900 cu.yd. open ditches.

Louisiana—Bd. Comrs. Gravity D. D. 2, Jefferson Davis Parish (Jennings) and Calcasieu Parish (Lake Charles), bids about Jan. 1, 35 mi. open ditch work, incl. 850,000 cu.yd excav., A. E. Parent, Bell City, engr. E. Miller of Lacassine, M. J. Sharp, J. Leger and F. Dennison of Iowa, La., are comrs.

La., Hammond — Dec. 22, by Bd. Comrs. Tangipahoa D. D. 1, dredging 500,000 cu.yd excav., 180 acres clearing. E. G. Frieler, engr.

N. Y., Glens Falls—Dec. 30, by R. D. Hayes, comr. Canals & Waterways, Dpt. P. Wks., State Office Bldg., Albany, repairing Glens Falls Feeder, Contr. M-69; adv. E. N.-R. Dec. 18.

CONTRACTS AWARDED

Florida—E. B. Ring, (general contractor), St. Petersburg, constructing over 6 mi. seawall Weber System Type C, to Shore-Line Builders, Inc., Liggett Bldg., Jacksonville, Miami and St. Petersburg, for Tocobavga Country Club, which has acquired entire Snell Islands, near St. Petersburg.

Ill., Chicago—Lincoln Park Comrs., Clark and Center Sts., L. M. Thomas, secy., 1,800 ft. breakwater from Montrose Ave. to Argyle St. incl. filling in between breakwater and extension outer drive north of Montrose Ave. (now under construction), also dike at Ainslie St. jetty at Montrose Ave., to Great Lakes Dredge & Dock Co., 104 South Michigan Ave., $846,400. Noted Nov. 20.

Illinois—Bd. Comrs. Union D. D. 1 South Homer Twp., Champaign Co. and Sidell Twp., Vermilion Co., excavating 11,652 ft. open ditch containing 17,018 cu.yd., to R. P. Stubblefield, Indianola. Noted Nov. 20.

Ia., Muscatine—Drainage work in Bay Island Drainage Dist., to J. Brogan & Sons, Green Bay, Wis. Plans later three 200 ft. bridges and 1,300,000 cu.yd. earth excav. C. H. Pitchforth, Muscatine, co. aud.

La., New Orleans—Gulf, Mobile & Northern R.R. Co., 71 Conti St., Mobile, Ala., L. P. O. Exley, ch. engr., 1,000,000 cu.yd. earth fill for railroad yard, to McWilliams Dredging Co. Canal Bank Bldg., New Orleans, La., and 75 East Wacker Dr., Chicago, Ill.

La., New Orleans—State Hy. Comn., Baton Route, 2 mi. embankment on New Orleans end of Chef Menteur Bridge, to Jahncke Service Inc., 814 Howard Ave., New Orleans, $126,648.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., widening deepening existing drainage ditch, to C. J. Agrios Eng. & Constr. Co., 726 8th Ave., New York, $8,510. Noted Nov. 27.

Ont., Riverside—Council, concrete breakwater along Lake St. Clair, to J. V. Barr, Edward St. at St. Rose Ave., $135,000. Noted Oct. 30.

Ont., Saulte Ste. Marie—See "Sewers."

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Public Bond Elections

Coming Bond Elections

Waterworks—Genoa, Colo., $20,000.
Sewerage System—Gonzales, Calif., $40,000.
Sewerage System—Manhattan, Kan., Dec. 18, $250,000.
Park Impvts.—San Francisco, Calif., $2,500,000.
Park Impvts.—Manhattan, Kan., $30,000.
City Hall and Library — Manhattan, Kan., $150,000.
Court House—Pope County, Ark., $150,000.
High School Additions — San Mateo, Calif., $300,000.

Bonds Voted

Waterworks Impvts.—St. Paul, Minn., $100,000.
Waterworks Ext. Well, Pump, etc.—Mountain Grove, Mo., $20,000.
Waterworks—La Conner, Wash., $45,000.
Power Plant—Cushing, Okla., $300,000.

Bonds Defeated

Waterworks Dist. System—Gilman City, Mo., $35,000.
Sewage Disposal Plant — Gilman City, Mo., $30,000.
Sewers—Maysville, Okla., $25,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Ark., Little Rock — POST OFFICE — Treas. Dpt. at office Sup. Archt., bids in spring, general contract 5 story, basement, 175 x 250 ft., rein.-con., brick, stone post office and federal building, Capitol Ave. and Gaines St. Noted Dec. 19.

Calif., Long Beach—FEDERAL BUILDING—Treas. Dpt. at office Sup. Archt., 2 story, basement, 135 x 199 ft., brick, steel, rein.-con., American Ave. and East 3rd St.

La., Baton Rouge—POST OFFICE and FEDERAL—Treas. Dpt. at office Sup. Archt., post office and federal building, Florida and St. Anthony Sts.

Mass., Palmer—POST OFFICE—Treas. Dpt. at office Sup. Archt., post office, Park and Central Sts.

Okla., El Reno — REFORMATORY — Dpt. Justice, federal reformatory.

Pa., Greenville—POST OFFICE—Treas. Dpt. at office Sup. Archt., 1 story, basement, 142 x 171 ft. post office, Clinton and Canal Sts. **Maturity 1931.**

Tex., Fort Worth—FEDERAL—Treas. Dpt., at office Sup. Archt., plans by W. C. Hedrick, Inc., Fort Worth, federal building.

Tex., Memphis—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office.

Va., Yorktown—PIERS—Spec. 6347—Yards & Docks, Navy Dpt., Wash., D. C., repairing piers.

Washington—DIKE—U. S. Eng., Seattle, improving mouth of Quillayute River, incl. dike between sandpit and James Island, jetty on Quillayute Reservation side of river.

BIDS ASKED

Calif., Richmond—TRAINING WALL—Jan. 8, by U. S. Eng., San Francisco, 81,000 tons core rock and 18,000 tons facing rock, extending training wall, Richmond Harbor. Noted Nov. 20.

D. C., Wash. — ELEVATOR — Spec. 6356 — Jan. 7, by Yards & Docks, Navy Dpt., electrical freight elevator.

D. C., Wash.—HOSPITAL—Jan. 6, by Dpt. Interior, obstetrical hospital addition.

D. C., Wash.—INSULATED CABLE—Dec. 23, by A. L. Flint, genl. purch. officer Panama Canal, insulated cable, steel sounding wire, steel tubing, glass edging machines, aluminum sheets, pipe and pipe fittings, Schedule 2615.

D. C., Wash.—PILES—Dec. 19, by A. L. Flint, general purch. agt., Panama Canal, creosoted southern yellow pine piles, Schedule 2614.

Ind., Lebanon—POST OFFICE—Jan. 6, by Treas. Dpt. at office Sup. Archt., U. S. Post Office; adv. E. N.-R. Dec. 18.

Louisiana—EARTHWORK—Dec. 29, by U. S. Eng. 2nd Dist., New Orleans, 76,000 cu.yd. earthwork in Red River and Bayou des Glaises Levee and Drainage Dist.

Mass., Boston—POST OFFICE—Jan. 20, by Treas. Dpt. at office Sup. Archt., superstructure 21 story, basement, sub-basement, brick, granite, limestone, post office Sq. Cram & Ferguson, 248 Boylston St., consult. archts. Noted Dec. 4.

New Jersey—DREDGING—Dec. 22, by U. S. Eng., 39 Whitehall St., New York, 46,729 cu.yd. overlying material and 58,666 cu.yd. ledge rock in Passaic River; adv. E. N.-R. Dec. 18. Noted Dec. 11.

N. C., Salisbury—POST OFFICE—Jan. 13, by Treas. Dpt., at office Sup. Archt., remodeling, extending U. S. Post Office, court house; adv. E. N.-R. Dec. 18.

Va., Langley Field—BARRACKS—Jan. 15, at office Constr. Q.M., Fort Monroe, constructing one 163 men, two 200 men and one 300 men barracks; adv. E. N.-R. Dec. 18.

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CONTRACTS AWARDED

Arizona—ROAD—C. H. Sweetser, dist. engr. P. Rds., 508 Ellis Bldg., Phoenix, grading 2.818 mi. Oak Creek Natl. Forest Rd., Coconino Natl. Forest, Coconino Co., to C. G. Willis & Co., 2119 East 25th St., Los Angeles, Calif., $149,069. Est. $222,110. Noted Nov. 20.

Ill., Rock Island—BARGES—U. S. Eng., ten 5 x 24 x 110 ft., steel material barges, to Midland Barge Co., Midland, Pa., $67,620. Noted Nov. 13.

Kan., Fort Riley—NURSES' QUARTERS—Con. Q. M., building for nurses' quarters, to Busboom Bros., Fairbury, $44,250. Noted Nov. 6.

Md., Fort Meade—NURSES' QUARTERS—Con. Q. M., constructing, completing nurses' quarters, to Minter Homes Corp., 340 3rd Ave., Huntington, W. Va., $38,150. Noted Nov. 6.

Mass., Rutland Heights—INCINERATOR—Vet. Bu., Arlington Bldg., incinerator building, additional equipment, to James Milos & Son Co., 25 Foster St., Worcester. Noted Oct. 23.

Missouri—DIKES—U. S. Eng., 428 Custom House, St. Louis, 4,000 lin.ft. piling dikes in Missouri River at Dozier and Centaur Bends, to Woods Bros. Constr. Co., 132 South 13th St., Kansas City, $151,791. Noted Nov. 6.

Mo., Kansas City—DIKES—U. S. Eng., 16,405 ft. standard clump dike and 5,950 ft. revetment at Camden and Sni Bends in Missouri River, to W. A. Ross Constr. Co., 25th and Summit Sts., Kansas City, $444,755. Noted Nov. 13.

Mo., Osage City—DIKES—U. S. Eng., Postal Telegraph Bldg., Kansas City, 8,270 ft. pile dikes, 3,300 ft. revetment in Missouri River at Rising Creek Bend and Cote San Dessein Reach, 2 mi. from here, to Bilhorn Bowers & Peters, Railway Exch. Bldg., Kansas City, $489,555. Noted Oct. 23.

Miss., Gulfport—BUILDINGS, etc.—Vet. Bu., Arlington Bldg., building and utilities, to H. B. Ryan Co., 500 North Dearborn St., Chicago, Ill., $405,800. Noted Nov. 6.

N. J., Fort Monmouth—QUARTERS—Con. Q. M., 6 double sets non-commissioned officers quarters, to J. A. Moraw & Owns Co., 144 West 47th St., Chicago, Ill., $78,519. Noted Nov. 27.

N. J., Lake Denmark — SHELL HOUSE MAGAZINES—Yards & Docks, Navy Dpt., general contract 1 story, basement, 50 x 200 ft., and 1 story, basement, 50 x 110 ft., brick, steel, to N. C. Nelson, Inc., 855 Bway., New York, $38,200. Noted Dec. 11 Daily.

N. Y., Oswego — BREAKWATER — U. S. Eng., Buffalo, Eastside Breakwater, 2,200 ft. long, arrowhead type, to A. Phelps & Son, 3619 Michigan Ave., Detroit, Mich., $60,362. Noted Dec. 11.

Va., Quantico—DREDGING—Spec. 6182—Yards & Docks, Navy Dpt., grading, filling, bridge, to Trimont Dredging Co., 10 State St., Boston, Mass., $473,380. Noted Nov. 6.

W. Va., Clarksburg—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to J. Largura & Co., 3672 Adams St., Gary, Ind., $278,500. Noted Nov. 6.

Wyo., Casper — POST OFFICE and COURT HOUSE—Treas. Dpt. at office Sup. Archt., general contract 3 story, basement, 37 x 158 ft., concrete, brick, sandstone, to Murch Bros. Constr. Co., Railway Exch. Bldg., St. Louis, Mo., $265,000. Noted Nov. 6.

FEDERAL POWER COMMISSION

Applications for License and Permits Licenses

1128—H. B. Smith, Merritt, Wash., wants license power project partly within Wenatchee Natl. Forest on Ellen Creek, in Chelan Co.

1129—G. Siverly, Telma, Wash., wants license power project partly within Wenatchee Natl. Forest, Chelan Co.

1130—York Mines Co., Helena, Mont., wants license constructed transmission line within Helena Natl. Forest, Lewis and Clark Co.

1131—Upright Shingle Co., 3925 Silver Beach, Bellingham, Wash., wants license power project within Mount Baker National Forest on slough off North Fork Nooksak River, Whatcom Co.

1132—E. M. Tunin, Hyak, Wash., wants license constructed power project within Wenatchee Natl. Forest on Wolf Creek, Kittitas Co

1133—Public Serv. Co. of Colorado, 15th and Champa Sts., Denver, Colo., wants transmission line partly on public land in Garfield and Mesa Counties.

1134—East Bay Municipal Utility Dist., Orinda St., Oakland, Calif., wants preliminary permit power project on Mokelumne River affecting public lands on Amador and Calaveras Counties.

1135—Citizens Light, Power & Water Co., Ketchikan, Alaska, wants preliminary permit power project within Tongass Natl. Forest, at outlet of Lake Perserverance, Alaska.

1136—California-Oregon Power Co., 58 Sutter St., San Francisco, Calif., wants license constructed transmission line affecting public lands in Kalmath Co., Ore.

1137—W. C. Parcher, Bishop, Calif., wants license power project within Inyo Natl. Forest, Green Creek, in Inyo Co.

1138—New England Fish Co., Ketchikan, Alaska, wants license transmission lir affecting public lands in Tongass Natl. Forest and in vicinity of Ketchikan.

RAILWAYS

BIDS ASKED

New York—Jan. 13, at office Dpt. Correction, W. N. Thayer, Jr., comr. State Office Bldg., Albany, track and trestle at Attica State Prison, Attica, Wyoming Co.; adv. E. N.-R. Dec. 18.

CONTRACTS AWARDED

Louisiana—See "Excavation, Drainage, Irrigation, Levees, River and Harbor under New Orleans."

Texas—Atchison, Topeka & Santa Fe Ry. Co., G. W. Harris, ch. engr. system, Chicago, Ill., 20 mi. railroad between Spearman and Morse, to Sharp & Fellow, 533 Central Bldg., Los Angeles, Calif. Noted Nov. 20.

SUBWAYS AND TUNNELS

BIDS ASKED

N. Y., New York—See "Sewers."

CONTRACTS AWARDED

N. Y., Brooklyn—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, subway under Lafayette Ave. from South Oxford St., to Bedford Ave., to Cornell Constr. Co., Grand Central Terminal, New York, $3,652,383. Noted Nov. 13.

N. Y., Long Island City—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, Sect. 9, Route 108, subsurface railroad along and under Queens Blvd., to A. A. Johnson Corp., West Ave. and 3rd St., $3,505,000. Noted Nov. 13.

GRADE CROSSINGS

PROPOSED WORK

Minn., Minneapolis—Chicago, Milwaukee, St. Paul & Pacific R.R. Co., C. F. Loweth, ch. engr., Union Sta., Chicago, Ill. and City, grade separation by elevating tracks from 6th Ave. S. to 24th St. E. in South Minneapolis. $4,000,000.

N. Y., Amherst—Lehigh Valley R.R. Co., G. T. Hand, ch. engr., 143 Liberty St., New York, eliminating Getzville Rd. Crossing. $41,100.

N. Y., East Syracuse—New York Central R.R. Co., F. B. Freeman, ch. engr., 366 Lexington Ave., New York, reconstructing bridge carrying Bridge St. over New York Central R.R., Onondaga Co. $194,900.

N. Y., Rochester—New York Central R.R. Co., F. B. Freeman, ch. engr., 366 Lexington Ave., New York, eliminating Blossom Road Crossing. $370,000.

Ont., Windsor—City, subway under Canadian Pacific R.R. on Ellis Ave. $650,000. Work will probably be done by day labor, under supervision of R. J. Desmarais, City Hall, engr.

BIDS ASKED

Wisconsin—Dec. 23, by State Hy. and Fond du Lac Co. Hy. Comms., Milwaukee, constructing Van Dyne Grade Separation, U. S. Hy. 41, S.A.P. 2844.

CONTRACTS AWARDED

Ala., Birmingham—City Comn., constructing 18th and 20th St. underpasses under railroad tracks, incl. stone and earth excav., 150 ft. long concrete walls on both sides underpasses, 8 ft. wide, underpasses 100 ft. wide, to Southern Constr. Co., 615 South 11th St., $277,926 est. $360,000; electrical work on L. & N. service station, to Roberts Electric Co., Birmingham, $444; heating, to Scholz & Hamil, 331 North 27th St.; railroad office plumbing and signal tower heating, to Veich Plumbing & Heating Co., 616 2nd Ave. N., $372 and $438 respectively; signal tower plumbing, to Morris Plumbing Co., 609 South 3rd St., $683. Noted Nov. 20.

Ill., La Grange—State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, F. T. Sheets, ch. hy. engr., 1,500 ft. viaduct, incl. approaches, with 44 ft. roadway, two 6 ft. sidewalks over Indiana Harbor R.R., on Ogden Ave., Route 8, and under right-of-way Burlington R.R., near here, to M. J. McDermott & Co., 105 South Dearborn St., Chicago. State of Illinois pays $100,000, Indiana Harbor R.R. Co., La Salle St. Sta., Chicago, O. Gersbach, ch. engr., $200,000, and Chicago, Burlington & Quincy R.R. Co., 547a West Jackson Blvd., Chicago, A. W. Newton, ch. engr., $50,000 toward cost. Cook Co. spent $75,000 for right-of-way.

N. Y., Lackawanna—New York Central R.R. Co., F. B. Freeman, ch. engr., 466 Lexington Ave., New York, reconstructing hy. bridge carrying Ridge Rd. over tracks of New York Central, Erie, Pennsylvania, New York, Chicago & St. Louis and Lehigh Valley Railroads, to W. H. Gahagan, 417 Remsen St., Brooklyn, $400,201. Est. $604,913.

N. Y., Mount Pleasant—Westchester Co. Park Comn., J. Downer, ch. engr., Bronxville, overcrossing at Bway., Hawthorne, 2 river bridges and grading in Bronx Parkway extension, Mount Pleasant, to Doyle & Daly, Arlington Ave. and 232nd St., New York, $188,259. Noted Nov. 13.

PIERS AND WHARVES

PROPOSED WORK

Calif., Oakland—PIER—City of Oakland Port Comn., 424 Oakland Bank Bldg., G. B. Hegardt, secy., rein.-con. pier, foot of Webster St. $185,000. Engineering Dpt. of Owners, engrs.

Mo., Kansas City — WHARF IMPROVEMENTS—City improving wharf, 1st and Main Sts. $130,000. R. Waddell, city engr. Henri-Lowry Eng. Co., 114 West 10th St., consult. engrs.

Piers and Wharves (Continued)

BIDS ASKED

Que., Montreal—WHARF—Dec. 23, by Harbor Comrs. of Montreal, continuation reconstruction of Windmill Point Wharf. Est. $1,500,000. P. LeClaire, 357 Common St., ch. engr.

CONTRACTS AWARDED

Calif., San Francisco—PIER—California State Harbor Comn., Ferry Bldg., Pier 23, rein.-con., to Healy-Tibbitts Constr. Co., 64 Pine St., $345,597.

La., New Orleans—WHARF DECK—Orleans Dock Bd., concrete wharf deck at Bienville Street Wharf, to T. Carey, Pan-American Bldg., $44,983. Noted Dec. 11.

Canada—WHARVES—Dpt. P. Wks., Ottawa, Ont., wharf at Louisburg, N. S., to C. R. MacDonald, Antigonish, N. S., $63,750—wharf at Tadoussac, Que., to H. Lemelin, St. Romaulde, Que., $39,930—extending wharf at Father Pt., Que., to U. Latouche, St. Louis de Courville, Que., $55,320. Grand total $159,000.

Quebec—WHARVES—Dpt. P. Wks., Ottawa, Ont., wharves at Pointe St. Pierre and at Point Theurant, to J. J. Lechere, St. Joachim, $18,000 and $26,473 respectively; extending wharf, to O. Arseneau, St. Omer, $23,408. Grand total $67,881.

AIRPORTS

PROPOSED WORK

La., New Orleans—Orleans Levee Bd., Camp and Common Sts., A. L. Schushan, pres., 2,600 x 4,500 ft. airport on 240 acre site, surrounded by concrete seawall, incl. 4,000,000 yd. sand and shell to fill in lake, four 3,000 ft. runways, 60 landings and takeoffs handled daily, $1,000,000. J. D. Klorer, New Orleans, engr.

BIDS ASKED

Ala., Birmingham—Dec. 22, by A. J. Hawkins, city engr., administration building, several steel, concrete hangars at municipal airport, $125,000.

POWER AND LIGHTING

PROPOSED WORK

N. J., Newark—Bd. City Comrs., City Hall, preliminary plans furnishing, installing traffic lights at various intersections, $50,000. J. Costello, city engr.

Ont., Toronto—City replacing street lights in northern portion city, $26,900. R. C. Harris, City Hall, engr.

BIDS ASKED

Calif., Los Angeles—Dec. 31, by Bd. P. Wks., City Hall, electroliers with underground system in Exposition Blvd. and Figueroa St. Lighting Dist., incl. Marbelite and metal standards, $25,000.

New York—Dec. 24, by Bd. Supervs. Westchester Co., Court House, White Plains, erecting, furnishing lighting fixtures for tuberculosis pavilion, and children's tuberculosis building at Grasslands Hospital, Walker Gillette, 599 Madison Ave., New York, archt.; adv. E. N.-R. Dec. 18.

N. Y., Brooklyn—Dec. 23, by Fire Dpt., J. J. Dorman, comr., Municipal Bldg., New York, portion underground fire alarm system in Flatbush, Prospect Park, and miscellaneous improvements.

CONTRACTS AWARDED

Calif., Pasadena—B. Chamberlain, city clk., steam generating equipment for municipal light plant, to C. C. Moore & Co., 108 West 6th St., San Francisco, $141,555. Noted Nov. 6.

Ind., Auburn — City Council reconstructing electric light and power lines, to Deal Electrical & Eng. Co., Ft. Wayne, $23,537. Est. $31,000. Noted Nov. 27.

N. Y., New York—A. Goldman, comr. Plant & Structures, Municipal Bldg., furnishing, installing conduit system and lamposts on approach, also lighting equipment on upper roadway of Queens Boro Bridge, to J. T. Riordan Co., 50 Dean St., Brooklyn, $10,950 and $14,670 respectively. Noted Nov. 27.

Texas—Central Power & Light Co., c/o Natl. Bank Commerce Bldg., San Antonio, 60 mi. high line from Carrizzo Springs to Eagle Pass, to furnish power to Eagle Pass Irrigation Project, to L. E. Meyers Co., Del Rio, $70,000.

Tex., Port Arthur—J. W. O'Neil, mayor, fire alarm system, to Gamewell Fire Alarm Co., Port Arthur, $35,372.

SPORTS AND PARKS

PROPOSED WORK

Calif., Eureka—Eureka City School Dist. preliminary plans swimming pool, $70,000. N. Ackerman, 102 West 4th St., archt.

Calif., Los Angeles—School Dist. 60x75 ft. and 50x60 ft. concrete swimming pools, $85,000. Austin & Ashley, Chamber of Commerce Bldg., archts.

Ill., Chicago — South Park Comrs., 5700 Cottage Grove Ave., E. J. Kelly, pres., soon takes bids on revised plans completing and equipping stadium at Soldiers Field, $800,000. L. White, 5700 Cottage Grove Ave., engr. Noted Nov. 7.

Okla., Bartlesville — G. Swain, preliminary plans lake and pleasure resort, near here, $30,000. Private plans.

Wash., Seattle—University of Washington stadium addition.

BIDS ASKED

Mass., Manchester — G. Putnam, Manchester Point, taking bids 60 ft. concrete swimming pool at Manchester Point. A. A. Shurcliff, 11 Beacon St., Boston, archt.

Minn., St. Paul—See "Schools."

N. Y., Long Island City—Dec. 23, by Dpt. Parks, W. R. Herrick, pres. Park Bd., Arsenal Bldg., Central Park, New York, grading, sheet asphalt on concrete paving Forest Parkway from Park Lane S. to Jamaica Ave.

CONTRACTS AWARDED

N. Y., Brooklyn—Manhattan Beach Bathing Parks, Inc., Ocean Ave. and Oriental Blvd., swimming pool, showers, grandstand, Shore Blvd. and Oxford St., to J. J. Guinan, 1469 Flatbush Ave. Est. exceeds $50,000. Noted Oct. 23.

N. Y., New York—Park Bd., W. R. Herrick, pres. Park Dpt., Central Park, restoring lawns Madison Square Park, to T. DiRoma, 33 Evelyn Pl., $6,800; 18 in. chain fence at Coleman Playground, to Atlas Fence Co. Inc., 103 Park Ave., $2,290. Noted Nov. 20.

N. Y., Rochester—City Building Dpt., general contract municipal bathhouse, Ontario Beach Park, to P. G. Hauck Co., 36 St. Paul St., Rochester, $170,788; plumbing, to W. Mack, 807 Dewey Ave., $16,341; heating, to Barr & Creelman, 74 Exchange St., $3,675; electrical work, to Laube Electric Co., 388 Main St. E., $9,874. Grand total $200,678. Noted Aug. 21.

HEATING AND VENTILATING

BIDS ASKED

N. Y., Beacon—Dec. 30, by Commissioner Dpt. Correction, State Office Bldg., Albany, heating work, central power plant, at Matteawan State Hospital; adv. E. N.-R. Dec. 18.

N. Y., Kings Park—Jan. 7, by Commissioner Dpt. Mental Hygiene, State Office Bldg., Albany, heating and electrical work for service connections new buildings, Kings Park State Hospital; adv. E. N.-R. Dec. 18.

N. Y., Ogdensburg—Jan. 7, by Commissioner Dpt. Mental Hygiene, State Office Bldg., heating, additional boiler capacity and equipment in St. Lawrence State Hospital; adv. E. N.-R. Dec. 18.

CONTRACTS AWARDED

Mass., Boston—Boston Floating Hospital, 244 Washington St., heating and ventilating in hospital, Nassau and Ash Sts., to Lynch & Woodward, 320 Dover St., est. $25,000; plumbing, to F. E. Cassidy, 60 Broadway, Cambridge, and electrical work, to E. C. Lewis, Inc., 121 Federal St., est. $25,000. Noted Nov. 13 under "Hospitals."

Mass., Boston—New England Medical Center, J. A. Cousens, pres., heating in Medical school, clinic and dormitory, to Lynch & Woodward, 320 Dover St.; plumbing, to F. E. Cassidy, 60 Broadway, Cambridge; electrical work, to E. C. Lewis, Inc., 121 Federal St., Est. $25,000. Noted Oct. 2, under "Hospitals."

R. I., Pawtucket—Memorial Hospital, E. N. Littlefield, heating and ventilating in children's and maternity building, to Lincoln & Lane Co., 30 Bayley St., est. $25,000; plumbing, to F. Dupuis Co., 599 Main St., and electrical work to New England Machine & Electric Co., 77 Bayley St., est. $25,000 or more. Noted Sept. 18, under "Hospitals."

UNCLASSIFIED

PROPOSED WORK

Minn., Minneapolis — COAL TERMINAL — City, coal terminal, rein.-con., foot Washington Ave. South bridge, $200,000. Construction may begin in 1931, advancing cost with expectation of being reimbursed by Federal Government later. N. W. Elsberg, city engr.

Mo., St. Louis — STREET CAR SAFETY ZONES—City, c/o Dpt. Streets & Sewers, preliminary plans 100 concrete platform type zones, with lights and guards and 200 mushroom bottom zones with light reflectors, $65,000.

N. Y., Brooklyn—COMFORT STATION—Dpt. Parks, Municipal Bldg., New York, comfort station, Prospect Park, Ocean and Parkside Aves., $40,000. J. L. Kennedy, 157 Remsen St., archt.

Okla., Erick — GAS SYSTEM — Preliminary plans natural gas system. Election soon $50,000 bonds for same. E. E. Conner, mayor.

Okla., Okmulgee—PIPE LINE, etc.—Great Lakes Pipe Line Co., Tulsa, 15 mi. each 4 in. and 6 in. gasoline pipe lines, steel, at refinery $100,000; gasoline pump station, near here, $160,000. F. E. Richardson, Tulsa, engr.

Okla., Wagoner—GAS DISTRIBUTION—City preliminary plans municipal gas distribution system, $40,000. S. L. Hatfield, city clk.

BIDS ASKED

Mass., Adams—TOWER—Massachusetts War Memorial Comn., W. H. Eaton, South St., Pittsfield, taking bids Beacon Memorial Tower, granite, concrete, on Mt. Greylock, $25,000 or more. Maginnis & Walsh, Statler Bldg., Boston, archts. Noted Oct. 16.

Nebraska — CULVERT PIPE — Dec. 27, by State Dpt. P. Wks., Lincoln, culvert pipe in roads in Harland, Clay and Logan Counties, R. L. Cochran, state hy. engr.

N. J., Camden — ASSEMBLY PLANT — See "Contracts Awarded."

CONTRACTS AWARDED

Ill., Peoria—WHARF BARGE—Wharf barge in connection with pier terminals, to Howard Shipyards & Dock Co., Jeffersonville, Ind., $63,733. Noted July 31.

Mich., Plymouth — TUNNEL PIPING — Detroit House of Correction, 1441 Alfred St., Detroit, tunnel piping for underground heating, for various buildings on prison farm, near here, to H. Kelly & Co., 609 Free Press Bldg., Detroit, $29,766; main sewer for buildings, to M. Clearbout, 400 Penobscot Bldg., Detroit, $12,376.

N. J., Camden—ASSEMBLY PLANT—Radio Corp. of America, Woolworth Bldg., New York, altering and installing belt assembly system for radio division at Radio-Victor plant, day labor. To exceed $40,000.

N. Y., New York — BORINGS — Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., borings along 6th Ave., to Giles Drilling Co., 19 West 44th St., $13,288. Noted Dec. 1 Daily.

N. Y., New York—COMFORT STATION—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., general contract Comfort Station 21, to M. Fass, $19,097; plumbing, to A. Beckerman, 937 Jackson Ave., $2,764; heating, to Sugarman & Leon, 1003 Boston Rd., $1,300. Grand total $23,165. Noted Nov. 27.

Okla., Ponca City—PUMPING STATIONS and BOILER HOUSE—Great Lakes Pipe Line Co., 7 concrete, brick, steel, to A. G. McKee & Co., 2422 Euclid Ave., Cleveland, O. Est. $650,000.

Pa., Neville Island (mail McKees Rock)—SILOS—Davison Coke & Iron Co., superstructure 6 cement storage silos, 80 ft. high, 35 ft. diam., to Rust Constr. Co., Koppers Bldg., Pittsburgh, $58,948.

O., Columbus — ELEVATORS — State Office Building Comn., State House, 10 electric elevators in Ohio State Office Building, to Otis Elevator Co., 1374 East 6th St., Cleveland, $222,976. Noted Dec. 4.

Texas and Missouri—BOOSTER PUMPS, etc. —Phillips Petroleum Co., Bartlesville, Okla., supplying necessary booster pumps for gasoline pipe line (now under construction) between Borger, Tex., and St. Louis, Mo., to Worthington Pump & Mchy. Corp., 2 Park Ave., New York; 19 gas engines, 265 hp. each, to Chicago Pneumatic Tool Co., 6 East 44th St., New York.

MATERIALS

PROPOSED WORK

ROAD OIL—**Fresno, Calif.**—D. M. Barnwell, clk. Fresno Co., bids in January, 125,000 to 175,000 bbl. road oil. C. P. Jensen, Fresno, co. surv.

BIDS ASKED

GALVANIZED FENCING—**Los Angeles, Calif.** Dec. 29, by Bd. Supervs. Los Angeles Co., 25 rolls 26 in. wide, 100 rolls 58 in., 25 rolls 42 in. 55 rolls 34 in., 20 rolls 26 in., 10 rolls 50 in. 25 rolls 42 in., 100 rolls 34 in. and 100 rolls 58 in. galvanized fencing for flood control work.

VARNISHED WIRE and CABLE—**Los Angeles, Calif.**—Dec. 24, by City Purchasing Agent, 30,000 ft. No. 6 A.W.G. soft-drawn 7-strand, single conductor, 5,000 volt varnished cambric wire in coils about 500 ft. each; 5,000 ft. No. 4 same as above in reels of 1,000 ft. each; 5,000 ft. No. 6 same as above 1-strand in 1,000 ft. reels, Spec. 2218.

TELEPHONE LINE MATERIALS—**Los Angeles, Calif.**—Bd. Supervs. Los Angeles Co., taking bids material for telephone line for county flood control department, incl. lumber, locust pins, insulators, cross-arms, bolts, wire, etc.

PIG LEAD — **Oakland, Calif.** — East Bay Municipal taking new bids 50 tons pig lead. Former bids rejected. Noted Dec. 11.

CEMENT—**Chicago, Ill.**—Jan. 12, by Comrs. Cook Co., County Bldg., G. A. Quinlan, supt., 750,000 bbl. cement for 1931 hy. requirements.

LUMBER, PIPE, etc.—**Creston, Ia.**—Dec. 22, at office Auditor Union Co., 130,000 ft. standard sawed fir lumber, 65,000 ft. creosoted bridge lumber, 4,500 lin.ft. creosoted piling, 3,822 lin.ft. corrugated pipe. A. K. Olsen, Creston, co. engr.

PIPE, LEAD, etc.—**Bogalusa, La.**—Jan. 6, by City Clerk, 3,100 ft. 16 in. and 1,200 ft. 12 in. bell and spigot Class "B" pipe, 9,400 lb. caulking lead, 395 lb. jute, also fittings, bends, Class "B."

BRICK — **Minneapolis, Minn.** — Dec. 26, by F. S. Gram, city purch. agt., City Hall, 275,000 exterior face brick, for Bd. Educ.

CONCRETE PIPE—**Greenville, Miss.**—Jan. 5, by City Engineer, furnishing, delivering along side of ditches 3,500 ft. 72 in., 1,000 ft. 48 in., 600 ft. 42 in., 600 ft. 36 in. concrete pipe.

ASPHALTIC CEMENT, etc. — **Long Island City, N. Y.**—Dec. 22, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., 400,000 gal. asphaltic cement in barges alongside dock at Asphalt Plant 1, Flushing; 300,000 gal. fuel oil; 1,000 tons asphaltic cement in tank wagons at Asphalt Plant 3, Forest Hills, 400,000 gal. road oil; 25,000 tons steam ashes alongside Dock at Asphalt Plant 1, Flushing.

WOOD PAVING BLOCKS—**New York, N. Y.** —Dec. 24, by P. J. Dooling, comr. Purchase, Municipal Bldg., granite and wood paving blocks to Dpt. Plant & Structures.

WATER PIPE—**Milwaukee, Wis.**—Dec. 23, by Central Bd. Purchases, J. W. Nicholson, purch. agt. 6,000 tons 6- to 16-in. Class "C"

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Materials (Continued)
water pipe: 350 tons special castings, consisting 3 ways, 4 ways, curves, sleeves, reducers, caps, etc.; 90 tons Class "D" offset pipes; 7 tons 6- to 16-in. tapping sleeves; 600 fire hydrants; one thousand 6 in. gates valves; six hundred 8- to 12-in. gate valves, one hundred ninety-five 2- to 6-in. tapping valves; 1,000 D. D. valve boxes complete; 300 top sections (without covers); 400 extension pieces; 90,000 lb. liquid chlorine.

CONTRACTS AWARDED

GRANITE PAVING BLOCKS—**Portland, Me.**—Purchasing Agent, City Hall, granite paving blocks, to F. M. Blaisdell & Son, Franklin, at $88 per 1,000; and to Hildreth Granite Co., 31 State St., Boston, Mass., $89.50.

CAST IRON PIPE—**Beaumont, Tex.**—City, c/o R. Edmond, 6 and 8 in. c.i. pipe, to McWane C.I. Pipe Co., Beaumont, $1,000.

CAST IRON PIPE, etc.—**Port Arthur, Tex.**—J. W. O'Neil, mayor, 450 ft. c.i. pipe, valves, fittings, to National Cast Iron Pipe Co., 911 Main St., Houston. Est. $10,349.

CAST IRON PIPE—**Ottawa, Ont.**—City, furnishing 3,504 ft. 16 in. c.i. pipe, to Alexander Fleck Ltd., 428 Wellington St.; twelve 6 in. and six 16 in. gate valves, to Jenkins Bros., 617 St. Remi St., Montreal, Que. Est. $14,000.

EQUIPMENT

PROPOSED WORK

DIESEL ENGINE — **Gridley, Calif.** — City, Diesel engine at municipal light plant.

TRACTOR—**Kalispell, Mont.**—City, purchasing tractor. F. P. Scott, city engr.

BIDS ASKED

BLADE GRADER—**Park Rapids, Minn.**—Jan. 6, by F. Heisel, aud, Hubbard Co., 12 ft. blade grader. A. R. Taubman, co. hy. engr.

FOREIGN

China — International General Electric Co., 120 Bway., New York, and Tokyo Electric Co., Tokyo, Japan, plan electric lamp manufacturing plant at Dairen, South Manchuria. $1,500,000.

Mexico, Nogales—John Morrell & Co., Ottumwa, Ia., plans meat packing plant. To exceed $40,000.

Buildings

RESIDENTIAL

BIDS ASKED

Calif., San Francisco — See "Contracts Awarded."

Mo., Clayton—Syndicate, c/o S. Hamburg, Jr., 1034 Arcade Bldg., St. Louis, bids early in January, general contract ten 2 story, basement, Blue Ridge Terrace. $600,000. Martiz & Young, Inc., 116 Chemical Bldg., archts.

N. Y., Brooklyn—See "Contracts Awarded."

N. C., Charlotte—Macklenburg County **Land** Corp., c/o K. Murchison, pres., 101 Park Ave., New York, 18 story hotel, theatre, Tryon and 3rd Sts. **Maturity in February, 1931.** T. M. Murchison, 101 Park Ave., New York, archt. W. H. Gompert, 101 Park Ave., New York, assoc. archt. Noted Oct. 30.

Pa., Bradford—Dec. 19, by Hotel Holley, R. A. Fulton, prop., 149 Main St., 4 story and top addition, 100x100 ft., brick, cast stone, 149 Main St. $150,000. Lawrie & Green, 821 North 3rd St., Harrisburg, archts.

Pa., Phila.—W. Freihofer, 20th and Indiana Sts., taking bids 4 story, basement, 99x127 ft., brick, steel, incl. stores, plain found., Paul and Orthodox Sts. $300,000. G. H. Murphy, 4432 Frankford Ave., archt.

Ont., Toronto—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Los Angeles—Franklin & Las Palmas Corp. Ltd., Franklin and Las Palmas Aves., 12 story, basement 130 x 150 ft., Class A, steel, rein.-con., Franklin and Las Palmas Aves., to H. I. Beller Constr. Co., 6513 Hollywood Blvd., $500,000.

Calif., San Francisco—E. Jose, 251 Kearny St., 6 story, basement, rein.-con. Jackson St. near Gough St., day labor. $175,000.

Kan., Wichita—**Western Hotel & Building Co.,** c/o J. W. Gerhardt, 425 North Topeka St., 18 story, basement, 110 x 159 ft., steel, concrete, to Fisher Constr. Co., 320 North Michigan Ave., Chicago, Ill. Est. $1,500,000. General contractor taking bids on sub-contracts.

Me., Portland—Dartmouth Real Estate Co., F. A. Rumery, pres., 533 Forest Ave., 4 story, basement, brick, plain found., Ricker Park, Dartmouth and Baxter Blvds., to F. A. Rumery Co., 533 Forest Ave. $275,000.

Miss., Jackson—C. N. Flowers, 4 story, basement, High St. $150,000. Owner builds. N. W. Overstreet, Mississippi Fire Insurance Bldg., archt.

N. Y., Brooklyn—Bunting Realty Corp., M. Rothschild, pres., 766 Montgomery St., 6 story, 84 x 140 ft., Bunting St., separate contracts, $200,000. Cohn Bros., 361 Stone Ave., archt.

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N. Y., Brooklyn—Fishkind Homes Corp., W. Fishkind, pres., 1415 46th St., 6 story, 84 x 100 ft., East 19th St. and Quentin Rd., separate contracts. $165,000. S. L. Malkind, 93 Court St., archt.

N. Y., Brooklyn—Marine Building Corp., N. Ssokolow, secy., 4210 Church Ave., 6 story, 106 x 214 ft., Marine and 4th Aves., separate contracts. $350,000. M. Hirsch, 350 Stone Ave., archt.

N. Y., Brooklyn — One Hundred East 19th Street Corp., D. Goldstein, pres., 16 Court St., 6 story, 140 x 200 ft., Albermarle Rd. and East 19th Sts., separate contracts. $650,000. W. T. McCarthy, 147 Pierrepont Ave., archt.

N. Y., Brooklyn—Puritz Goldman, Inc., I. Goldman, pres., 458 Quentin Rd., 6 story, 70 x 100 ft., East 19th St. and Dorchester Rd., day labor and separate contracts. $150,000. M. Rothstein, 186 Joralemon Ave., archt.

N. Y., Brooklyn—Ritzen Constr. Corp., A. Ritzenberg, pres., 1043 Nostrand Ave., 6 story, 63 x 124 ft., East 19th St. and Avenue L, separate contracts. $300,000. M. Weinstein, 93 Court St., archt.

N. Y., Brooklyn—Sorch Realty Corp., 211 East 53rd St., 6 story, 100 x 109 ft., Lenox Rd. and Bedford Ave., separate contracts. $175,000. Cohn Bros., 361 Stone Ave., archt.

N. Y., New York—Corporation, c/o S. Metsch, 4756 3rd Ave., apartment, Walton Ave. and 182nd St., to Landis Constr. Co., 4756 3rd Ave. Est. $150,000.

N. Y., New York—Fifty 7th Avenue Corp., E. Kayo, pres., 424 Madison Ave., 19 story, 80 x 112 ft., to Kidansky & Levy, 424 Madison Ave. Est. $1,000,000. Contractor taking separate contract bids. Noted Dec. 11.

N. Y., New York—Metropolitan Temple, 91 7th Ave., apartments, 7th Ave. near 13th St., to Ambrose Realty Co. (contractor and lessee), 57 William St., New York. Est. $1,000,000.

N. Y., New York—Wabasco Realty Co., S. Lobel, pres., 2 Lafayette St., 6 story, 75 x 93 ft., Nelson Ave. and 167th St., separate contracts. $150,000. Franklin, Bates & Heindsmann, 2526 Webster Ave., archts.

Okla., Oklahoma City—W. B. Skirvin, 1st St. and Bway., 2 story, basement, 100 x 140 ft., brick, steel addition to Skirvin Tower Hotel, caisson found., 1st St., also tunnel to present hotel, to Campbell & Price, 605½ West Main St., $2,000,000. Noted Aug. 28.

Pa., Bryn Mawr—Owner, 4, 5 and 6 story, basement, 150 x 150 ft., brick, steel, plain found., to Stewart Bros., 3509 North 10th St., Phila.

Wash., Seattle — Meyers & Telander, Inc., Smith Tower, 3 story, basement, 37 x 110 ft., brick, steel, 517 1st Ave. W. $150,000. Owner builds. L. Baeder, Smith Tower, archt.

Ont., Toronto — D. E. Bennett, Trust & Guarantee Bldg., 4 story, basement, 63 x 100 ft., brick, stone, steel, separate contracts. $175,000. Excavation awarded, to Orsini & Co., 1411 Dufferin St. H. G. Duerr, Lumsden Bldg., archt. Noted Aug. 7.

CLUBS

PROPOSED WORK

Ill., Chicago—Illinois Auto Club, 3401 South Michigan Ave., plans by B. M. Maher, 157 East Erie St., 10 story auto club building. $500,000.

N. Y., New York — Railroad Y. M. C. A., National Bureau Y. M. C. A., 347 Madison Ave., bids after Dec. 22, general contract club, $2,000,000. Warren & Wetmore, 16 East 47th St., archts. Noted Nov. 19.

BIDS ASKED

Mass., Somerville (br. Boston) — Somerville Y. M. C. A., 101 Highland Ave., Boston, taking bids altering and constructing (3rd unit) 4 story, basement, brick dormitory addition, plain found., $150,000; heating, plumbing and electrical work, $25,000. W. Atherton, 148 State St., Boston, archt. Noted Oct. 16.

CONTRACTS AWARDED

O., Cleveland—C. R. Greco, archt., Guardian Bldg., 2 story, stucco, stone, tile, steel club house addition, Warrensville Center Rd., to Sam W. Emerson Co., 1836 Euclid Ave., for Oakwood Club, c/o J. M. Berne, pres., 1520 Warrensville Center Rd. Est. $150,000. Noted Nov. 20.

HOSPITALS

PROPOSED WORK

Minn., Duluth—City bids in January, Miller Memorial Hospital. $600,000. J. Wilson, city engr.

N. J., Weehawken—North Hudson Hospital, Park Ave., raising $350,000 funds 5 story, basement, brick, steel nurses' home, training school, Columbia Terrace. **Maturity indefinite.** Sullivan W. Jones & Associates, Inc., 25 West 45th St., New York, archts. Noted Nov. 6.

N. Y., Brooklyn—Dpt. Hospitals, Municipal Bldg., New York, soon takes bids general contract nurses home at Greenpoint Hospital, Kingsland Ave. $278,000. C. B. Meyers, 31 Union Sq., New York, archt.

N. Y., Brooklyn—Swedish Hospital, Rogers Ave., bids after Dec. 15, general contract hospital addition, Bedford Ave. $150,000. Crow, Lewis & Wick, 200 5th Ave., New York, archts. Noted Sept. 25.

N. Y., White Plains — St. Agnes Hospital, North St., bids after Dec. 15, general contract hospital, $900,000. F. J. Murphy, 280 West 246th St., New York, archt. Noted Oct. 2.

BIDS ASKED

Calif., Long Beach—See "Streets and Roads."

N. Y., Otisville—Dec. 30, by S. W. Wynne, pres. Bd. Health, Dpt. Health, 505 Pearl St., New York, altering and constructing research laboratory additions.

Ont., Port Arthur—See "Contracts Awarded."

CONTRACTS AWARDED

N. Y., Newburgh—St. Luke's Hospital, 70 Dubois St., hospital, to G. A. Fuller Co., 597 Madison Ave., New York. Est. $700,000.

B. C., Vancouver — Sisters of Charity, St. Paul's Hospital, Comox St., 6 story, 45 x 225 ft., rein.-con., vitr. brick, terra cotta hospital addition, to Carter Halls Aldinger Co., Standard Bank Bldg. Est. $400,000, excavating. Noted Oct. 23.

CHURCHES

PROPOSED WORK

N. J., East Orange—Central Brick Presbyterian Church, H. E. Nicely, 113 Woodlawn St., Orange, 2 story, basement, brick, steel church, $150,000. Mayers, Murray & Philip, 2 West 47th St., New York, archts.

N. J., Guttenberg—Little Church on the Hill, D. R. Reese, pastor, 326 24th St., sketches 2 story, basement, brick, steel, Bergenline Ave. $150,000.

N. J., Rutherford—Rutherford Congregational Church, C. E. Dunn, pastor, 23 Sunderland Ave., 2 story, brick, steel, Union Ave. $150,000. **Maturity indefinite.** Architect not selected.

N. Y., New York—Metropolitan Temple, 91 7th Ave., church, 7th Ave. and 13th St. **Maturity in January.** $300,000. Noted Oct. 9.

BIDS ASKED

Mich., Bloomfield Hills — A. Des Rosiers, archt. and engr., 1418 Maccabees Bldg., Detroit, taking bids concrete, stone, steel chapel, 350 seating capacity, plain found., Stoneycroft Ave. for St. Hugo Memorial Chapel, T. F. McManus, c/o architect.

CONTRACTS AWARDED

Mo., St. Louis—St. Nicholas Greek Orthodox Congregation, c/o A. G. Rally, chn. building com., 824 Market St., 2½ story, basement, 59 x 107 ft., rein.-con., brick, Forest Park Blvd. near Kingshighway, to C. A. Welsch Constr. Co., 53 DeMenil Bldg. Est. $225,000. Noted June 26.

N. Y., Brooklyn—Grace Church, 97 Columbia Heights, parish house, rectory, to J. Thatcher & Son, 60 Park Ave. Est. $150,000. Noted Dec. 4.

SCHOOLS

PROPOSED WORK

Calif., Los Angeles—University of California, 405 Hilgrade Ave., Westwood, Los Angeles, plans by G. W. Kelham, assoc. archt., 315 Montgomery St., San Francisco, and Allison & Allison, California Reserve Bldg., 2 gymnasium buildings, on campus. $800,000.

Ill., Alton—St. Marys Catholic Parish, c/o J. J. Brune, pastor, soon lets contract on revised plans 3 story, basement, irregular shaped, 51 x 53 x 121 x 123 ft., rein.-con., brick, school, 2 story, basement, 51 x 82 ft. sisters' home, 3rd and Henry Sts. $200,000. H. P. Hess, 1001 Ambassador Bldg., St. Louis, Mo., archt. Noted Sept. 11.

Mich., Monroe—St. Mary Academy, Servants of Immaculate Heart of Mary, plans by D. A. Bohlen & Sons, 1001 Majestic Bldg., Indianapolis, Ind., rebuilding 2 or 3 story, basement, steel, brick, concrete convent, incl. dining hall, power plant, plain found., West Elm Ave., recently destroyed by fire. $250,000.

Mo., St. Joseph—Bd. Educ., A. L. Loving, secy., bids after Jan. 15, Lindbergh School, 2 story, basement, rein.-con., brick, stone, St. Joseph St. and Concord Ave. $160,000. W. Siemens, 503 Bartlett Bldg., St. Joseph, and W. B. Ittner, Inc., Continental Life Bldg., St. Louis, assoc. archts.

N. J., Bergenfield—Bd. Educ., C. S. Dicker, dist. clk., 45 Smith Ave., sketches by A. Dore, 173 Main St., Hackensack, 2 story, basement, brick, steel, rein.-con., east of Prospect Ave. $180,000. Noted Feb. 20 Daily.

N. J., Butler — Bd. Educ., High School, 2 story, basement, brick, steel high school addition, $150,000 or more. **Maturity probably soon.** Architect not selected.

N. J., Edgewater—Bd. Educ., River Rd., 2 story, basement, brick, steel high school. $150,000. Architect not selected.

N. J., Hasbrouck Heights — Bd. Educ., Administration Bldg., sketches by Tooker & Marsh, 101 Park Ave., New York, Junior and Senior High School, 2 story, basement, brick, steel. $150,000. Noted Nov. 20.

N. J., Linden—Bd. Educ., St. George Ave., 2 story, basement, brick, steel, rein.-con. addition to Senior High School, St. George Ave. $380,000. Project in abeyance. Noted Nov. 20.

N. J., Westwood—Bd. Educ. plans by A. Dore, archt., 173 Main St., Hackensack, general contract altering and constructing 2 story, brick, steel high school addition, 3rd Ave. $200,000. Noted Dec. 11.

N. J., Wyckoff—Bd. Educ., School Bldg., new sketches by Lee & Hewitt, 152 Market St., Paterson, 2 story, brick, steel, plain found., Grand View Ave. $150,000. Noted Oct. 30.

Schools (Continued)

N. Y., New York — New York Institute for Education of Blind, 999 Pelham Parkway, plans by McKim, Mead & White, 101 Park Ave., 2 story, basement, 20 x 131 ft. school, dormitory, Pelham Parkway and Bronxwood Ave. $300,000.

N. Y., College Point—Bd. Educ., 500 Park Ave., New York, soon takes bids P. S. 129, 128th St. and 7th Ave. $415,000. C. W. Martin, Flatbush Ave. extension and Concord St., Brooklyn, archt. Noted Nov. 20.

Pa., Collegeville—F. R. Watson, archt., Architects Bldg., Phila. soon lets contract Science Hall, 3½ story, basement, 100 x 186 ft., rein.-con., brick, steel, plain found., for Ursinus College. J. M. Anders, chn. building comn.

R. I., Providence — City, Dpt. P. Buildings, soon takes bids on revised plans altering and constructing 2 story, basement, brick, stone school addition, plain found. $300,000. T. J. H. Pierce, City Hall, archt. Noted July 24.

Va., Petersburg—State of Virginia sketches by W. R. McCornack, 10006 Carnegie Ave., Cleveland, O., 3 story, brick, steel, concrete industrial college. $1,000,000.

Ont., Ottawa—French Oblate Fathers, Ottawa University, Laurier Ave. E., bids in spring normal school, Wilbrod St. $200,000.

BIDS ASKED

Calif., Santa Barbara—Dec. 29, by Bd. Educ., Jefferson School, 2 story, concrete, for Santa Barbara City School Dist. $160,000.

D. C., Wash.—Dec. 30, by District Comrs., District Bldg., Charles Young Platoon School.

Mich., Detroit—Dec. 29, by Bd. Educ., 1354 Broadway Ave., 2 story, basement, brick, rein.-con., steel, stone, plain found., Wyoming Ave. $382,000. Malcolmson, Higginbotham & Trout, 1217 Griswold St., archts.

Minn., St. Paul—Dec. 23, by C. A. Carlson, city purch. agt., c/o Dpt. Educ., City Hall, general contract 2 story, basement, rein.-con., brick school, incl. swimming pool, Pleasant Ave. and Sherman St. $200,000. C. A. Bassford, City Hall, archt.

N. J., Linden—Bd. Educ., St. George Ave., bids about Feb. 15, 2 story, basement, brick, steel, rein.-con. addition to School 2, plain found., Wood Ave. $150,000. H. B. Brady, Inc., 333 North Broad St., Elizabeth, archt. Noted Oct. 2.

N. J., Sea Bright — Bd. Educ., bids about Feb. 15, altering and constructing 2 story, basement, brick, steel addition, River St. $150,000. H. B. Seymour, 512 McClellan Ave., Long Branch, archt. Noted Oct. 23.

N. J., Ventnor (br. Atlantic City)—Dec. 19, by E. G. Perrot, archt., 1211 Arch St., Phila., Pa., general contract 3 story, basement, brick, steel school, convent, Portland Ave., for St. James Roman Catholic Church, G. Moran, pastor. $200,000. Noted Nov. 27.

N. Y., Woodhaven—Dec. 22, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, general contract addition to P. S. 63, Sutter Ave., from 90th and 91st Sts., for Bd. Educ., 500 Park Ave., New York.

CONTRACTS AWARDED

Calif., Napa—LaSalle Institute, Martinez, 3 story (4 units and chapel) rein.-con. school buildings, to J. P. Brennan, 354 Hobart St., Oakland. Est. $350,000.

Calif., San Francisco — City and San Francisco Co., general contract Lick Junior High School, Class A, rein.-con., 25th and Noe Sts., to Anderson & Ringrose, 320 Market St., $484,000; plumbing, to Turner Co., 229 Tehama St., $28,600; mechanical equipment, to H. Lawson, 465 Tehama St., $37,000; electrical work, to Alta Electric Co., 976 Indiana St., $31,190. Grand total $580,790.

Calif., San Jose—G. B. Dougall, state archt., P. Wks. Bldg., Sacramento, general contract 1 and part 2 story, rein.-con. gymnasium, to J. J. Groden, 1028 San Antonia Ave., Alameda, for State of California (State Teachers College). $97,525. Noted Nov. 20.

D. C., Wash.—District Comrs., District Bldg., Horace Mann School, to North-Eastern Constr. Co., 6 West Madison St., Baltimore, Md., $132,500. Noted Nov. 20.

Ill., Chicago—Bd. Educ., 188 West Randolph St., E. Whithall, bus. mgr., to W. B. Perry Co., 416 West Erie St., fireproofing Wendell Phillips Senior High School, rein.-con., brick, steel, stone, incl. 3 gymnasiums, lunch room, laboratories, science hall, shops, lecture halls $109,850; to L. Vallas, 2848 West Lake St., roofing $13,230; to Ruda Mfg. Co., 2308 South Kedzie St., sheet metal $30,333; to New City Iron Wks., 2301 Ward St., structural steel $139,280, miscellaneous steel and iron $36,868, steel erection $58,900; to E. E. Young, 7553 Cregier St., carpentry $192,432; to P. Gottordo, 635 South Taylor Ave., Oak Park, painting $53,500; to Amer. Glass Co., 20 North Sangamon St., glass and glazing $24,543; to Vitrolite Glass Co., 20 Sangamon St., structural glass $101,078; to W. Williams, 2841 Edgwood Ave., plastering $151,235, to Amer. Mosiac & Terrozo Co., 1730 Carrol St., terrozo and tile $122,283; to Corley Meservey Marble Co., 601 West 53rd St., marble $45,000; to H. P. Reger & Co., 159 North State St., steam heating $192,839; to Natl. Regulator Co., 2301 North Knox Ave., heat regulation $11,110; to G. E. Mathias Co., 5658 South Western Ave., ventilation $121,000; to S. Kersten, 554 West Jackson Blvd., plumbing $167,060; to Link-Belt Co., 900 South Michigan Ave., coal and ash conveyor $8,750; to Wadeford Electric Co., 205 West Wacker Dr., electrical work $231,538, grand total $1,810,829. General contract, from Lind Constr. Co., 6404 South State St. $509,000; steel lockers from Berger Mfg. Co., 228 North La Salle St., $19,587 not yet awarded. Noted Oct. 23.

Ind., Ft. Wayne—Bd. School Comrs., general contract rein.-con., brick, to W. A. Sheets Constr. Co., 315 Cal-Wayne Bldg. Est. $150,000. Noted Oct. 16.

Mass., Cambridge—Massachusetts Institute of Technology, 5 story, basement, brick, limestone, steel physics laboratory, plain found., Charles River Rd., and 2 story, basement, rein.-con. spectroscopic laboratory, concrete found., Massachusetts Ave. and Memorial Dr., to Stone & Webster, Inc., 49 Federal St., Boston. Est. $800,000 and $150,000 or more respectively. Noted Dec. 11 and Nov. 13 respectively.

Mich., Detroit—Malcalmson, Higginbotham & Trout, archts., 1217 Griswold St., 3 story, basement, 150 x 175 ft., brick, steel, concrete, limestone high school group, plain found., Cambridge Ave., to Otto Misch Co., 159 East Columbia St., for University of Detroit, Livernois Ave. and 6 Mile Rd. Est. $650,000. Noted Sept. 4.

N. J., Port Colden—Bd. Educ., Washington Twp., F. K. Rupell, clk., general contract 1 story, basement, 70 x 120 ft., brick, steel, plain found., to Stonebank & Nase, 348 Franklin St., Quakertown, Pa.; plumbing, to J. M. O'Donnell & Son, Quakertown, Pa.; heating, to F. Rieker, Ferry and Front Sts., Easton, Pa.; electrical work, to W. A. Gydeman, Inc., 129 Ferry St., Easton, Pa. Noted Nov. 20.

N. Y., Flushing—Bd. Educ., 500 Park Ave., New York, general contract P. S. 24, Holly Ave., to Raymore Constr. Co., 361 Tremont Ave., New York, $285,580. Noted Nov. 27.

N. Y., Sunnyside—Bd. Educ., 500 Park Ave., New York, general contract P. S. 150, to Sylvestri Bros., 480 East 145th St., New York, $459,000. Noted Oct. 23.

O., Columbus—C. E. Steeb, secy. Bd. Trustees, Ohio State University, 3 story, 47 x 60 ft., brick, concrete botany and zoology addition at Ohio State University, to J. I. Barnes, Springfield, $92,930; plumbing, to Huffman-Wolfe Co., 669 North High St., $36,532. Noted Nov. 20.

R. I., Cranston—City, general contract, 2 story, basement, brick, stone, plain found., to O. and S. Lavigne Co., 10 Weybosset St., Providence, $127,455; heating, to F. Duputis Co., 599 Main St., Pawtucket, $17,410; plumbing, to T. R. Douglas, 22 Sabin St., Providence, $5,583; electrical work, to City Electric Co., 80 Mathewson St., Providence, $4,000. Grand total $154,448. Noted Dec. 4.

Tenn., Nashville—Fisk University, 3 story, tower, 80 x 150 ft., incl. 12 laboratories, lecture hall, offices, to Rock City Constr. Co., 137 4th Ave. N.; equipment, to Kewanee Mfg. Co., Kewanee, Wis., $25,000. Total est. $160,000. Noted Aug. 7.

Utah, American Fork—State, Building Comm., Salt Lake City, general contract 2 brick dormitories, service building, laundry and power plant, to Jacobsen Constr. Co., 39 East 9th St. S., Salt Lake City, $180,000. Noted Dec. 4 Daily.

THEATRES

PROPOSED WORK

Calif., Merced—T. and D. Enterprises, Inc., c/o Reid Bros., archts., 105 Montgomery St., San Francisco, 2,000 seating capacity, Class A rein.-con. theatre. $300,000.

Calif., Santa Ana—United Artists, c/o Balch & Stanbery, archts., Film Exch. Bldg., Los Angeles, 50 x 150 ft., brick theatre, 1,000 seating capacity. $150,000.

Okla., Enid—Owner, c/o G. E. V. Blemenauer, archt., 233 Masonic Bldg., 12 story, basement, 125 x 200 ft., rein.-con., brick, stone theatre, office. $800,000. **Maturity about July.** Noted Aug. 28.

BIDS ASKED

N. J., Newark—Harris & Sohn, archts., 17 Mechanic St., taking bids 2 story, basement, brick, steel, plain found., Elwood Ave. and Bway., for Elwood Theatre, c/o architect, $150,000. Noted Sept. 26, 1929 under "Contracts Awarded." Foundation in under previous contract not completed.

BANKS

PROPOSED WORK

Mass., Somerville (Boston P. O.) — Winter Hill Co-Operative Bank, G. Lovejoy, pres., 88 Broadway, sketches 1 story, basement, brick, stone, to consist 3 separate buildings with one main entrance. $250,000. Architect not selected.

Mass., Weymouth—Weymouth Trust Co., 92 Pleasant St., sketches by Harper Trust Co., 92 State St., Boston, bank, Washington and Prospect Sts. $150,000 or more.

N. J., South Orange — South Orange Trust Co., 53 South Orange Ave., 2 story, basement bank addition. $150,000. Myers & Shanley, 24 Walnut St., Newark, archts. General contract bids in. **Maturity indefinite.** Noted Nov. 6.

BIDS ASKED

Mass., Winchester—Dec. 26, by Winchester Co-operative Bank, J. Challis, pres., and E. R. Wait, archt., Lawson Rd. extension, 1 story, basement, brick limestone, granite, rein.-con., concrete found., Vine St. $150,000 or more. Noted Nov. 20.

OFFICES

PROPOSED WORK

Calif., Sacramento—H. Mitau, et al., 1422 40th St., plans by G. Sellon & Co., California State Life Bldg., 16 story, basement, Class A rein.-con. office, 8th and J Sts. $750,000.

Ia., Des Moines — Bd. Directors, Iowa-Des Moines Natl. Bank & Trust Co., L. C. Kurtz, chn., 6th and Walnut Sts., soon lets contract 5 story (ultimately 21 story) basement, 125 x 135 ft., concrete, brick, stone bank, offices, stores, shops, 6th and Walnut Sts. $1,500,000. Proudfoot, Rawson, Souers & Thompson, 810 Hubbell Bldg., archts. Noted Apr. 24.

N. Y., New York — Starrett Bros. & Eken, contractors, 101 Park Ave., bids in January, separate contracts 28 story office, 4th Ave. from 24th and 25th Sts., for Metropolitan Life Insurance Co., Madison Ave. and 24th St. $10,000,000. Noted Nov. 28, 1929 under "Contracts Awarded."

BIDS ASKED

N. J., Hackensack—Owner, c/o P. J. Jossier, archt., 240 Broad Ave., Palisades Park, bids about Feb. 15, general contract 2 story, basement, 60 x 120 ft., brick, steel office, showroom, stores, Main St. $150,000. Noted Oct. 9.

N. J., Paterson—Goodman & Shulman, archts., 20 Smith St., bids about Mar. 1, general contract Medical Tower Building, 10 story, basement, 50 x 75 ft., brick, steel, rein.-con., Bway. and Auburn Sts., for Medical Tower Building Corp., c/o architect. $600,000. Noted Nov. 13.

CONTRACTS AWARDED

N. J., Garfield — B. and E. Amusement Co., c/o H. Gerritsen, archt., 118 Passaic Ave., general contract altering 2 story, basement, brick, steel auditorium into theatre, plain found., to A. L. Steer, 118 Passaic Ave. Est. $150,000. Noted Dec. 4.

N. Y., Syracuse — Starrett Investing Corp., 101 Park Ave., top and side additions to office, garage, Harrison St. and Harrison Pl., to Starrett Bros. & Eikin, 101 Park Ave., New York. Est. exceeds $1,500,000.

STORES

PROPOSED WORK

Calif., San Mateo—Levy Bros., 200 2nd St., rein.-con. department store, 3rd Ave. $250,000 or more. Architect not selected.

Mass., Norwood—J. M. Folan, 648 Washington St., sketches by McLaughlin & Burr, 88 Tremont St., Boston, 3 or 4 story, basement, brick store, office, apartment, telephone exchange building, Washington St. $150,000. R. D. Kimball Co., 6 Beacon St., Boston, engrs.

BIDS ASKED

N. J., Newark—Owner, c/o E. A. McMurray, archt., 339 Millburn Ave., Millburn, bids about Jan. 15, general contract 2 story, basement, brick, steel store, apartment, 18th and Melrose Aves. $150,000.

Mo., St. Louis—See "Contracts Awarded."

CONTRACTS AWARDED

Mo., St. Louis—C. F. Levy, c/o Hub Furniture Co., 701 Washington Ave., remodeling 5 story, basement, 25 x 150 ft., brick, terra cotta store, 705 Washington Ave., sub-contracts under supervision W. S. Frank, archt., 4540 Parkview Ave.

Ont., Toronto—Rober Simpson Co., Ltd., 176 Yonge St., department store addition, to Geo. A. Fuller Co., 597 Madison Ave., New York, est. $400,000.

PUBLIC

PROPOSED WORK

Calif., Bakersfield — AUDITORIUM — City, sketches by C. Biggar, Haberfelde Bldg., Class A, probably rein.-con. municipal auditorium. $200,000.

Ind., East Chicago—LIBRARY—City, general contract rein.-con., brick to V. Chiabai, 4360 Washington St., Gary. Est. $150,000. Noted Sept. 25.

N. J., Irvington (br. Newark)—TOWN HALL—Bd. Town Comrs., Town Hall, bids about April, 3 story, basement, brick, steel, rein.-con. plain found., Lincoln and Park Places, Springfield and Nye Aves. $600,000. G. C. Higby Co., 207 Market St., Newark, archts.

N. J., Jersey City—STAFF HOUSE—Bd. City Comrs., City Hall, sketches by J. T. Rowland, Jr., 30 Journal Sq., 16 story, basement, Baldwin and Montgomery Sts. $150,000 or more.

N. Y., New York—POLICE STATION—Police Dpt., 400 Broome St., plans by T. E. O'Brien, archt. and engr., 400 Broome St., 3 story, 64 x 89 ft., Barkley and Revere Aves. $200,000.

BIDS ASKED

Calif., Pasadena—AUDITORIUM—Dec. 22, by Bd. City Directors rein.-con. municipal auditorium building. $1,000,000. Noted Oct. 23.

Calif., San Francisco—HOME—Jan. 21, by S. J. Hester, secy. Bd. P. Wks., City Hall, Laguna Honda Home to be known as Wards K and L, Class A, steel, brick. $388,500.

Mass., Fall River—FIRE STATION—Dec. 23, by City, and E. M. Corbett, archt., 49 Purchase St., 2 story, basement, 75 x 135 ft. brick, stone, steel, plain found., Bedford and Troy Sts. $150,000. E. F. Harrington, city engr. Noted Dec. 11.

N. Y., New York—COURT HOUSE—Dec. 22, by H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., excavating Bronx County building site within area bounded by Walton Ave. and 158th St. and Mott Ave. and East 161st St. Noted Apr. 17.

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Public (Continued)

CONTRACTS AWARDED

La., Baton Rouge—CAPITOL—H. P. Long, gov., general contract 33 story, marble, steel, limestone, brick, hollow tile, to George A. Fuller Co., Munsey Bldg., Wash., D. C., $2,394,000; heating and plumbing, to American Heating & Plumbing Co. Inc., 829 Baronne St., New Orleans, $289,987; electric equipment, to Evans Bros., Baton Rouge, and 511 Magazine St., New Orleans, $138,000; elevators, to Otis Elevator Co., 852 Carondolet St., New Orleans, $129,000. Grand total $2,950,987. Noted Nov. 20.

N. Y., New York—OFFICE—J. Miller, pres. Manhattan Boro, Municipal Bldg., founds. for new municipal building for Dpts. Health, Hospitals and Sanitation, to E. O. Roberts, 52 Vanderbilt Ave., $339,000. Noted Nov. 27.

BUILDINGS—UNCLASSIFIED

PROPOSED WORK

O., Cleveland—EXCHANGE—Ohio Bell Telephone Co., G. A. Kositsky, ch. engr., 750 Huron Rd., plans by A. W. Bailey, 750 Huron Rd., 2 or 3 story basement, brick, steel, concrete, 12300 St. Clair Ave. $150,000.

Pa., Pittsburgh — GARAGE — Koppers Co., Koppers Bldg., brick, rein.-con., 7th St. and Bigelow Blvd. To exceed $150,000. Private plans.

BIDS ASKED

Wash., Tacoma—EXCHANGE—Pacific Telephone & Telegraph Co., I. F. Dix, vice-pres., 1200 3rd St., Seattle, bids about Jan. 1. 4 story (ultimately 8 story) basement, 83 x 123 ft., brick, steel, 9th and Fawcett Aves. $500,000. Bebb & Gould, Hoge Bldg., Seattle, archts.

CONTRACTS AWARDED

Conn., New Britain — LIBRARY — Mary Richardson Hawley Memorial Library, G. T. Kimball, memorial library, High St., to Carlson & Torrell Co., 50 Dwight St. Est. $150,000.

Ind., Terre Haute—EXCHANGE—Amer. Telephone & Telegraph Co., 7th and Ohio Sts., general contract 4 story, basement, 83 x 102 ft., rein.-con., brick, stone, to Adams & Sanford Constr. Co., 12 Chamber of Commerce Bldg., Terre Haute. Est. $200,000.

Mass., Framingham—EXCHANGE—New England Telephone & Telegraph Co., 50 Oliver St., Boston, 3 story, basement, brick, stone, steel, rein.-con., concrete found., to I. P. Rocheford, 29 Arch St. Est. $150,000. Noted Nov. 27.

Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Santa Ana—SHEET GLASS MANUFACTURING PLANT—Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa., preliminary studies and surveys by Stone & Webster Eng. Co., 120 Bway., New York, 315 South Bway., Los Angeles, Calif., and 164 Bway., Boston, Mass. To exceed $1,000,000.

Colorado — PAPER MILL — International Paper Co., 220 East 42nd St., New York, sketches paper pulp mill at either Pueblo, Salida or Alamosa. $2,500,000-$5,000,000. **Maturity after Mar. 1.** Noted Sept. 25.

Ga., Austell—THREAD SPINNING PLANT—Clark Thread Co., 715 Broad St., Newark, N. J., plans by J. E. Sirrine & Co., archts. and engrs., Greenville, S. C., plant, $2,000,000.

N. J., Jersey City — MILK DISTRIBUTION SYSTEM—Sheffield Farms, 524 West 57th St., New York, milk distribution plant. To exceed $100,000.

N. J., Newark—FACTORY—Heller Tool Co., R. E. Heller, pres., 865 Mount Prospect Ave., 2 story, basement, brick, steel addition, Mount Prospect Ave. and Erie R.R. $40,000. Architect not selected.

N. J., North Bergen—FACTORY—Cinderella Slipper Co., M. Eisenberg, pres., 5700 Hudson Blvd., rebuilding 3 story, basement, 50x100 ft., brick, steel, Hudson Blvd. $50,000. **Maturity indefinite.**

N. Y., Brooklyn—FACTORY—D. Cuozzo, c/o F. Savignano, archt., 6005 14th Ave., will not build 100 x 100 ft. factory, Gravesend Ave. and Avenue J. $40,000. Project abandoned. Noted Oct. 9.

N. Y., Brooklyn—FACTORY—L. Davidson, archt., 104 West 42nd St., New York, 4 story, 150 x 376 ft., rein.-con., 38th St. and Dahill Rd., for Metwood Holding Corp., 1380 Metropolitan Ave. $550,000. **Maturity in May.** Noted Oct. 9.

N. Y., Brooklyn—ICE PLANT—Supreme Coal & Ice Co., L. Tarielli, pres., 551 Nostrand Ave., plans by Bly & Hamann, 551 Nostrand Ave., ice manufacturing plant, Lexington and Marcy Aves. $75,000.

O., Lorain—FACTORY—National Stove Wks., Lorain, J. R. Haley, plant mgr., subsidiary American Stove Co., Cleveland, plans by Carter-Richards Co., engrs. and archts., Engineers Bldg., Cleveland, 1 story enameling plant, brick, steel. $250,000. Noted Dec. 11.

Pa. Ardmore—NEWSPAPER PLANT—Dreher & Churchman, archts., Otis Bldg., Phila., soon lets contract rein.-con., brick, steel, for Suburban Co., c/o F. A. Cobeen, 34 South 17th St., Phila. $150,000.

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Pa., Portage—SILK MILL—Century Ribbon Mills, B. G. Bosley, local mgr., branch Century Ribbon Mills, 80 Madison Ave., New York, sketches 1 story, basement, 10,000 sq.ft. floor space, Cambria St. To exceed $50,000 incl. equipment. Architect not selected. **Maturity about Mar. 1.**

Texas — GAS PLANT IMPROVEMENTS — Southwest Distributing Co., subsidiary United Gas Co., 1601 West Commerce St., Houston, acquired Live Oak Gas Co. interests servicing Pleasanton and North Pleasanton and plans improving, extending same, incl. considerable pipe and probably 1 booster plant. Private plans.

Ont., New Toronto — CANNING PLANT — Campbell Soup Co., Ltd., Toronto, and 2nd and Market Sts., Camden, N. J., soup canning plant on 15 acre site. $300,000. Architect not selected.

BIDS ASKED

Conn., Hartford—PLANT—Standard Paper Co., 40-42 Market St., taking bids 3 story, 50 x 155 ft. warehouse, office, showroom and service. $100,000. A. Feinberg, 1127 Main St., archt.

N. J., Irvington (br. Newark)—CLEANING PLANT—See "Contracts Awarded."

N. J., Jersey City—PRINTING PLANT—Jersey City Printing Co., 160 Maple St., bids about Mar. 1, on revised plans 3 story, 130 x 240 ft., brick, steel addition, Maple St. $150,000. H. D. Scudder, Jr., 9 Clinton St., Newark, archt. Noted June 16, 1930.

N. Y., Syracuse—BOILER FACTORY—See "Contracts Awarded."

Wis., Milwaukee — FACTORY — Dec. 20, by Dick & Bauer, archts., 208 3rd St., 1 story, basement, 73 x 340 ft., brick, rein.-con., 30th St., for J. Rauschenberger Co., 30th and Hadley Sts.

Ont., Toronto—PRINTING PLANT—Dec. 22, by J. A. Thatcher, archt., 37 Cowan Ave., 6 story, basement, 56 x 116 ft., brick, steel, stone, concrete, for Monetary Times Printing Co. of Canada, 62 Church St. $100,000.

CONTRACTS AWARDED

Calif., Ripon — MILK PLANT — Meyenberg, Inc., Soledad, group rein.-con. hollow tile, corrugated buildings for evaporated milk plant, to H. H. Larsen & Co., 64 South Park St., San Francisco. $200,000.

Ind., Indianapolis—FACTORY—Smith Agricultural Chemical Co., 1850 Kentucky Ave., general contract brick, steel fertilization plant, 1850 Kentucky Ave., to Hall Constr. Co., 500 Bd. of Trade Bldg. Est. $40,000.

Mass., West Springfield (br. Springfield) — FACTORY—Springfield Wire & Tinsel Co., 68 Taylor St., brick, steel, concrete, concrete found., to L. S. Wood, 14 Stockbridge St., Springfield. Est. $40,000.

Mich., Detroit—FACTORY and BINDERY—Detroit Mailing & Binding Co., 3128 Grand River Ave., 2 story, part basement, 80 x 100 ft., brick, rein.-con., plain found., 4th Ave., to James S. Holden Co., 2150 Buhl Bldg. Est. $87,000.

Neb., Beatrice—GAS PLANT—Empire Gas Co., c/o W. W. Smith, resident engr., Beatrice, general contract gas plant, to Siedhoff Constr. Co., Broadview Hotel, Wichita, Kan.; grading, to Abel Constr. Co., 308 Terminal Bldg., Lincoln. Est. $530,000.

N. J., Elizabeth — AUTO BODY PLANT — Fischer & Dackermann, 1153 Chestnut St., general contract altering and constructing 1 story, basement, brick, steel addition, to Wilhelm Constr. Co., 119 Division St. Est. $40,000. Noted Nov. 13.

N. J., Freehold—RUG MILL—A. and M. Karaghenusian, Inc., Jackson St., general contract 2 story, basement, 77 x 150 ft., and 1 story, basement, 51 x 90 ft., brick, steel, rein.-con. addition, along Central R.R. tracks, to W. Steele & Sons, Inc., 15th and Cherry Sts., Phila, Pa. Est. $40,000.

N. J., Irvington (br. Newark)—CLEANING PLANT—Co-Operative Cleaning Plant, Inc., I. Rappaport, pres., 83 Cordier St., general contract 2 story, basement, 40 x 100 ft., brick, steel, plain found., Cardier St., separate contracts. $40,000. H. A. Ciufi, 17 Academy St., Newark, archt.

N. Y., Brooklyn—BAKERY—G. F. Stuhmer & Co., 570 7th Ave., New York, altering bakery, to Sobray-Whitcomb, 105 West 40th St., New York. Est. $40,000. Noted Oct. 23.

N. Y., New York—BOTTLING PLANT—Six Hundred Thirty Five West 54th Street Corp., bottling and distribution plant, 630 West 55th St., to G. Richard Davis, 12 East 41st St. Est. $400,000. G. B. Seely's Son, 319 West 15th St., lessee.

N. Y., Syracuse—BOILER FACTORY—Pierce, Butler & Pierce Mfg. Corp., 41 East 42nd St., general contract boiler plant, day labor and separate contracts. To exceed $100,000. Noted Sept. 11.

Pa., Phila.—FACTORY—Owner, c/o C. E. Wunder, archt., Architects Bldg., 4 story, basement, 31 x 51 ft. and 18 x 31 ft., brick, steel, 105 North 5th St., to Cramp Co., Denckla Bldg., Smith, Kline & French Co. (druggists), 105 North 5th St., lessee.

Tex., Taylor—ICE PLANT—E. A. Clausnitzer, New Braunfels and Taylor, 1 story, brick, rein.-con., steel, plain found., to W. Sippel, New Braunfels. $18,000. Est. $45,000 incl. machinery. Noted Oct. 23.

Wis., Milwaukee — FACTORY — Wrought Washer Co., 46 South Bay St., general contract 1 story, 150 x 267 ft., 133 x 209 ft. and 96 x 340 ft. factory addition, South Bay St., to Klug & Smith, 69 East Wisconsin Ave.; roofing, to Winding Roofing Co., Milwaukee. Est. $175,000.

See proposal advertising on page 92

GARAGES

PROPOSED WORK

N. Y., Long Island City—D. H. Yeoman, 89-15 187th St., Hollis, sketches by J. A. Boyle, 367 Fulton St., Brooklyn, service garage, 54th St. and 21st Ave. $50,000.

N. Y., New York—Twenty-Five Rose Street Corp., c/o L. J. Witkin, 11 West 42nd St., 3 story service and parking garage, 31 Rose St. To exceed $100,000.

Tex., San Angelo—Firestone Tire Co., c/o J. B. Hallman, San Angelo soon lets contract, 2 story, brick, hollow tile, steel, rein.-con. super station, West Concho Ave. and Irving St. $100,000.

CONTRACTS AWARDED

Conn., New Haven — Todd Rubber Co., 125 Whalley Ave., 1 story, 60 x 78 ft. and 45 x 125 ft., brick, steel, concrete service garage, to Fusco & Amatruda, 36 Amity Rd. Est. $40,000. Noted Nov. 13.

Mass., Provincetown—J. H. Connolly, Depot Sq., Hyannis, 1 story, concrete, steel service garage, concrete found., to Bassett & Kendrick, East Harwich. $50,000.

Ore., Portland—Union Pacific R.R. Co., H. C. Mann, ch. engr., 1416 Dodge St., Omaha, Neb., general contract 1 story, 100 x 100 ft., brick, steel bus and truck garage, Stout and Jefferson Sts., to D. E. Alm, 655 East 37th St. N., $45,000.

SHOPS AND FOUNDRIES

BIDS ASKED

Mo., St. Louis—FOUNDRY—See "Contracts Awarded."

N. Y., New York—INSPECTION SHED, etc. —Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., inspection shed and service building, Concourse Yard, to J. T. Brady Co., 103 Park Ave., $689,926. Noted Nov. 27.

CONTRACTS AWARDED

Mo., St. Louis—FOUNDRY—Century Electric Co., 1806 Pine St., 1 story, 43 x 94 ft. and 41 x 286 ft., concrete, brick, steel addition, 3763 Market St., separate contracts. E. J. Lawler, 3727 Market St., archt.

POWER PLANTS

PROPOSED WORK

Ind., Greenfield—City plans by O. P. Gordon, Greenfield, brick, steel addition to power plant, incl. new switchboard, new generator and new engines. $55,000.

BIDS ASKED

Calif., San Francisco—Regents of University of California, Berkeley, taking bids steel, concrete power plant, 3rd and Parnassus Aves. $40,000 exclusive of equipment. W. C. Hays, Crocker 1st Natl. Bank Bldg., archt.

Mass., Fitchburg—Crocker-Burbank Co., 545 Westminster St., taking bids 2 story, brick, steel power plant extension. $40,000 or more. F. J. Sill, East Main St., Westboro, engr.

Mass., Wellesley—Town, Water & Municipal Light Comrs., Taylor Blk., taking bids altering and constructing 1 story, brick, steel sub-power station addition. $40,000. Private plans.

Kan., Kansas City—Dec. 29, by Bd. Public Utilities, C. A. Lowder, secy., structural steel for 1 and 2 story, basement, 84 ft. high, 94 x 130 ft., rein.-con., brick, steel power plant, Quainpaw Water Plant site. Bids about Jan. 1, general contract for above. Total $250,000. Burns & McDonnell Eng. Co., 406 Interstate Bldg., Kansas City, Mo., engrs.

CONTRACTS AWARDED

Mich., Detroit—Public Lighting Comn., East Atwater St., electrical work at Woodward Ave. Terminal Station, Philip Ave. Substation, and Ludden Switching Station, to Collier Constr. Co., 721 Free Press Bldg., $70,820. Noted Aug. 14.

WAREHOUSES

PROPOSED WORK

N. J., Camden — South Jersey Port Comn., U. S. Jeffreys, secy., 106 Market St., sketches by C. W. Stamford, engr. and archt., 50 Church St., New York, 2 story, basement, 160 x 300 ft., rein.-con., plain found., incl. railroad siding, concrete roads, Delaware River front between Clinton and Pine Sts. $500,000.

BIDS ASKED

Mo., St. Louis—Glauser Meat Co., A. Glauser, pres., 2136 Market St., bids about Jan. 15, 1 story, 68 x 150 ft., concrete warehouse, 1 story, basement, 53 x 129 ft., brick, concrete, steel cooler building, 704-6 South Spring Ave., Aegerter & Bailey, 1904 Railway Exch. Bldg., archts.

N. Y., Brooklyn—See "Contracts Awarded."

Mo., St. Louis—Washington University, remodeling 10 story, basement, rein.-con., brick office, warehouse, 1505 Washington Ave., to James Black Masonry & Contg. Co., Louderman Bldg. Est. $60,000. International Shoe Co., 1505 Washington Ave., lessee.

N. J., Jersey City—Eagle Grocery Co., c/o R. W. Sailor, archt., 76 Montgomery St., general contract 1 story, 60x100 ft., brick, steel warehouse addition, 1st and Provost Sts., to Hudson Concrete Constr. Co., 454 Montgomery St. Est. $40,000.

N. Y., Brooklyn—H. K. Ferguson Co., owner and lessee, 25 West 43rd St., New York, 3 story storage, day labor and separate contracts. $50,000. Noted Dec. 4.